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Contents for February 15, 1930

VOLUME 28, NUMBER 7

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A Forecast of the St. Louis Show 280
Brief descriptions of the planned exhibits with a layout of the buildings, list of exhibitors and the show schedule. — BY LESLIE E. NEVILLE

What Are the Prospects for 1930? 290
Leaders of the industry discuss the problems of production and sales for this year.

The Aircraft Industry in 1929 306
A general résumé of last year's aeronautical progress. — BY R. SIDNEY BOWEN, JR.

Flights of 1929 311
Sound development features the year's achievements. — BY JOHN T. NEVILL AND ADAM LONG

Aircraft Finance During 1929 315
Reviewing the industry's financial status. — BY K. REID CAMPBELL

Air Transport Development in 1929 318
Last year's growth and indications of future progress. — BY CHARLES F. MCREYNOLDS

Last Year's Airport Construction Projects 323
1929 program featured by great expansion. — BY CHARLES H. GALE

1929 Design Trends 327
Airplane and engine design tendencies of the past year. — BY LESLIE E. NEVILLE

Airplane Design in 1930 331
Leading engineers and plane builders venture their opinions of the 1930 trend in airplane design.

The Engine Builders Look at 1930 341
A collective forecast of the engine design tendency by the power plant engineers and manufacturers.

EDITORIALS 279
GENERAL NEWS 349
AIRPORTS AND AIRLINES 358
FOREIGN ACTIVITIES 361

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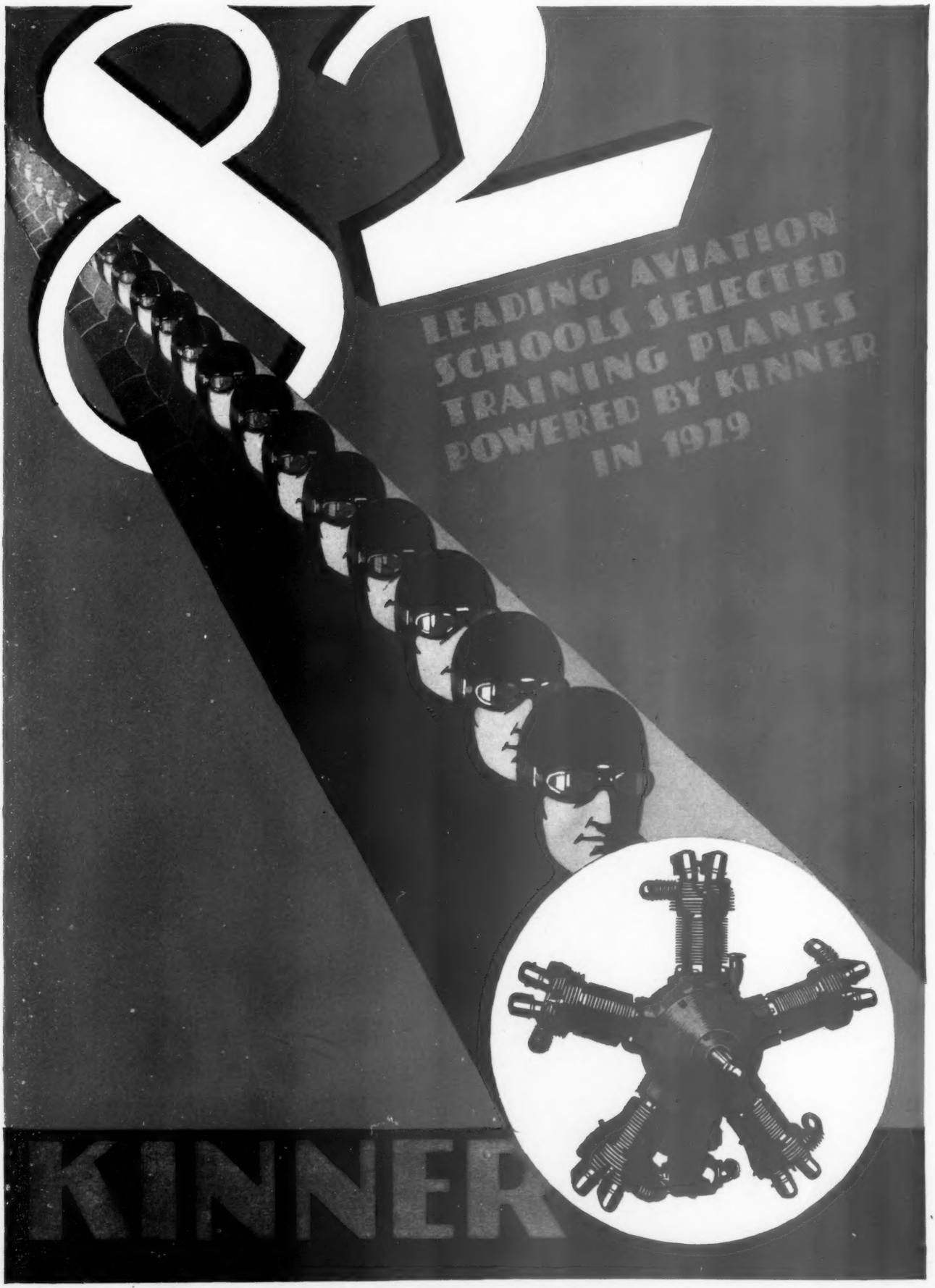
LEADING AVIATION SCHOOLS SELECTED TRAINING PLANES POWERED BY KINNER IN 1929
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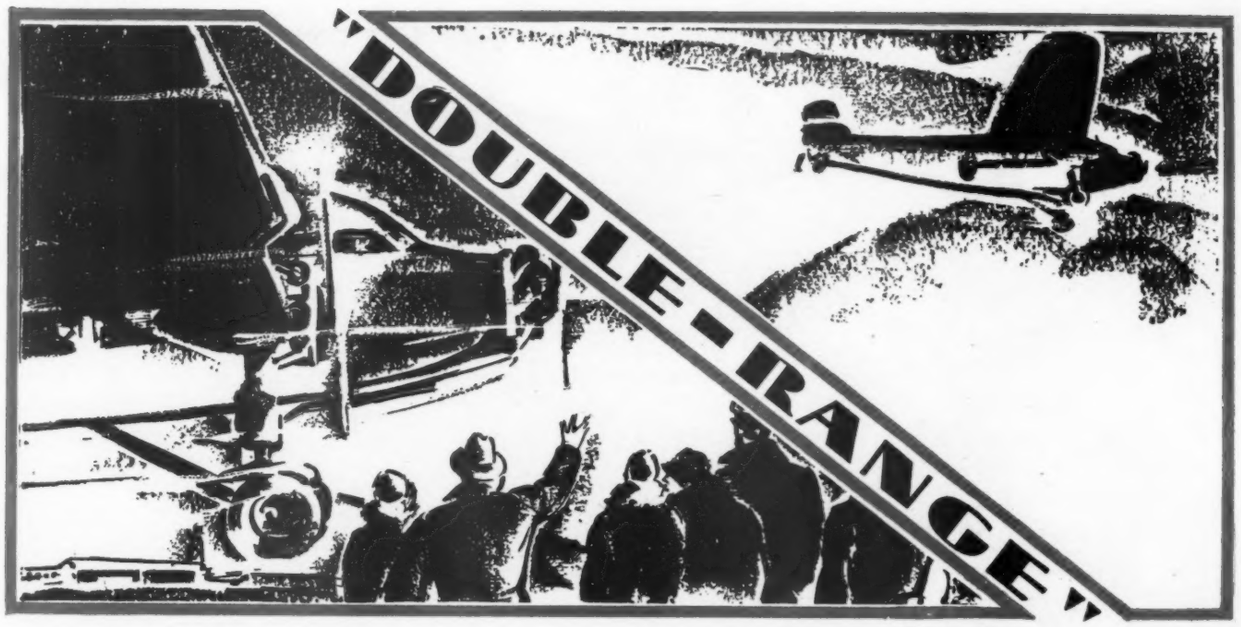

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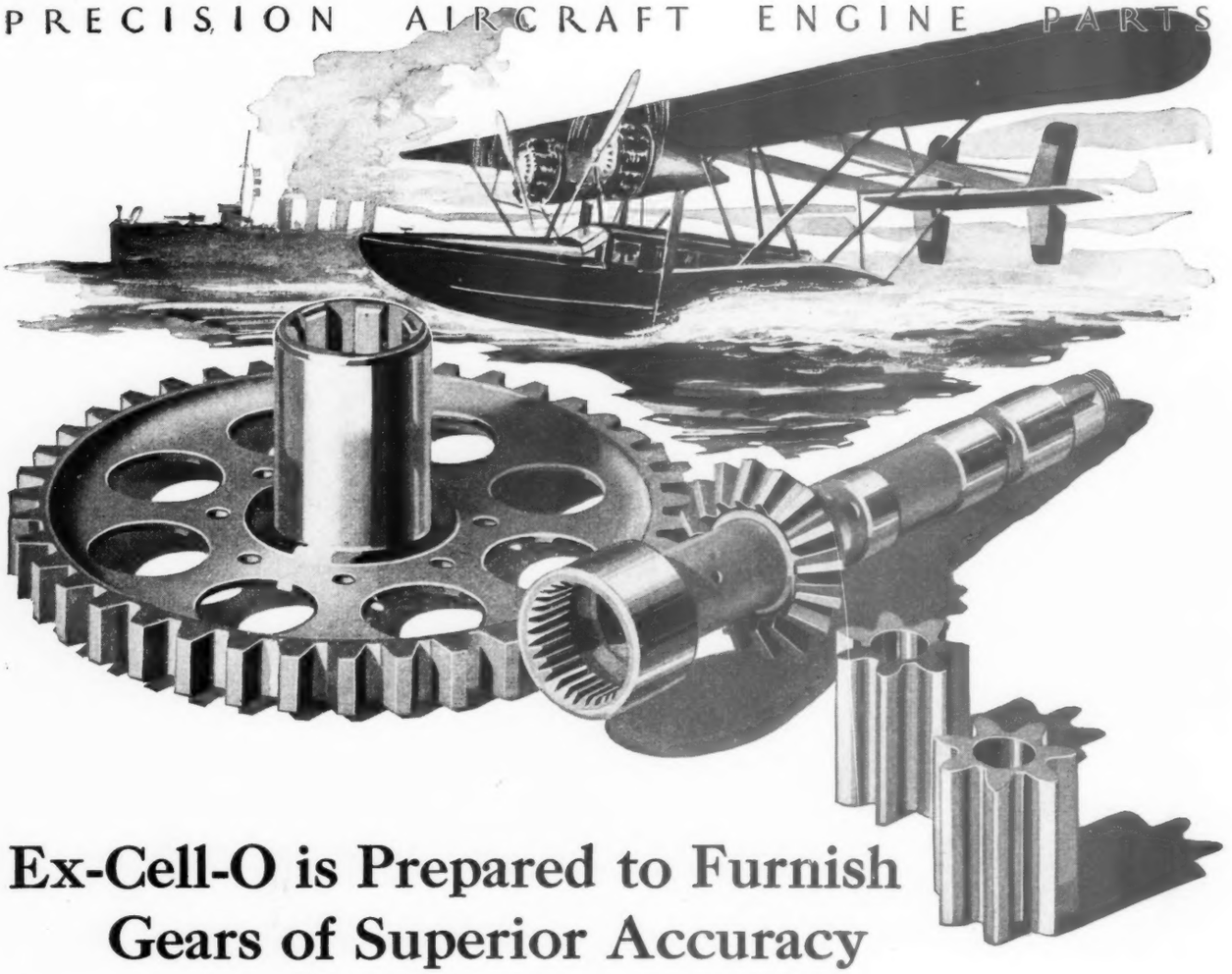

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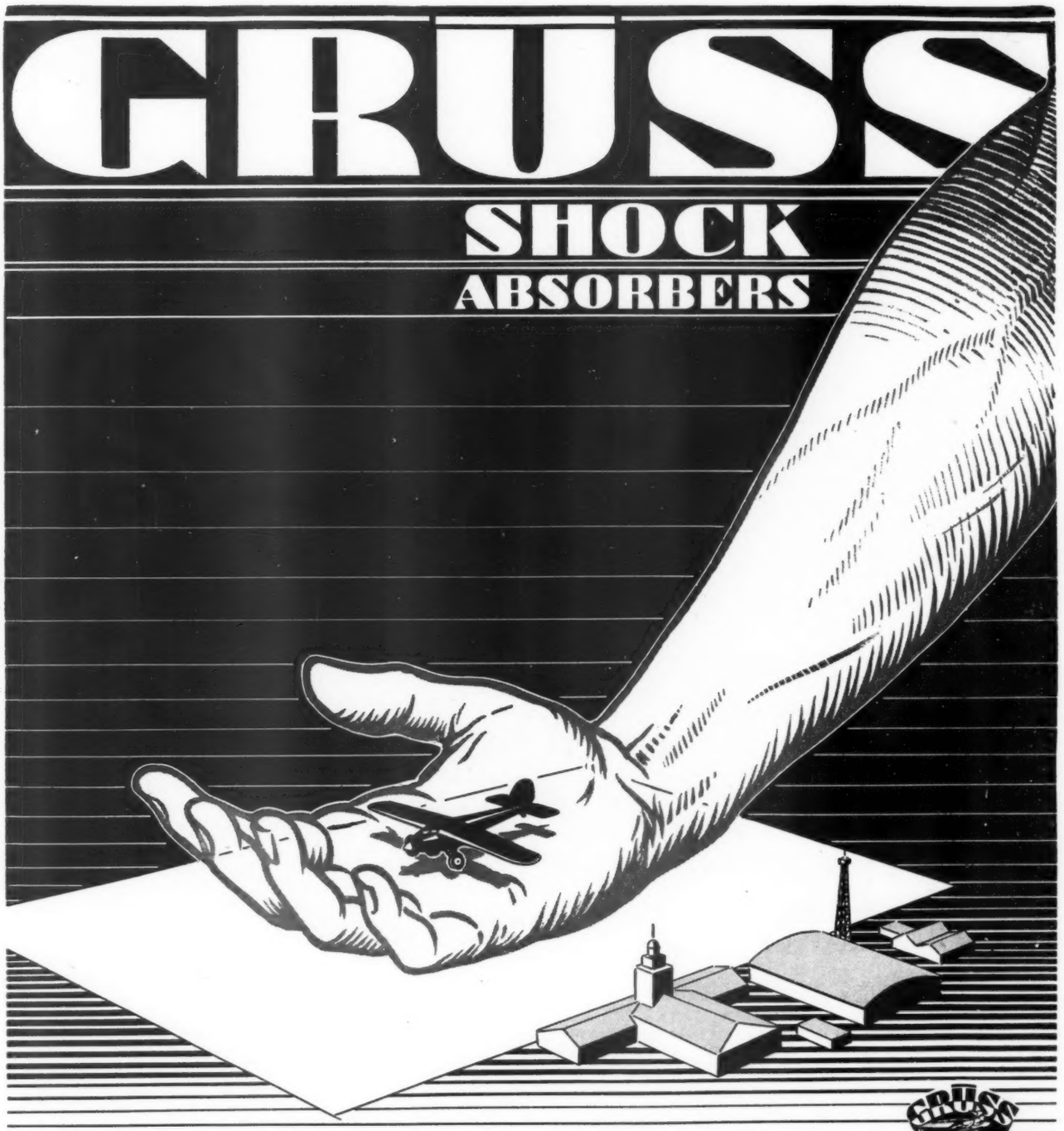

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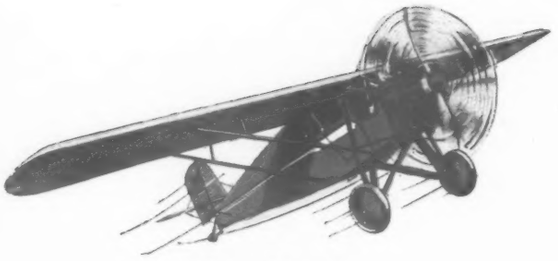

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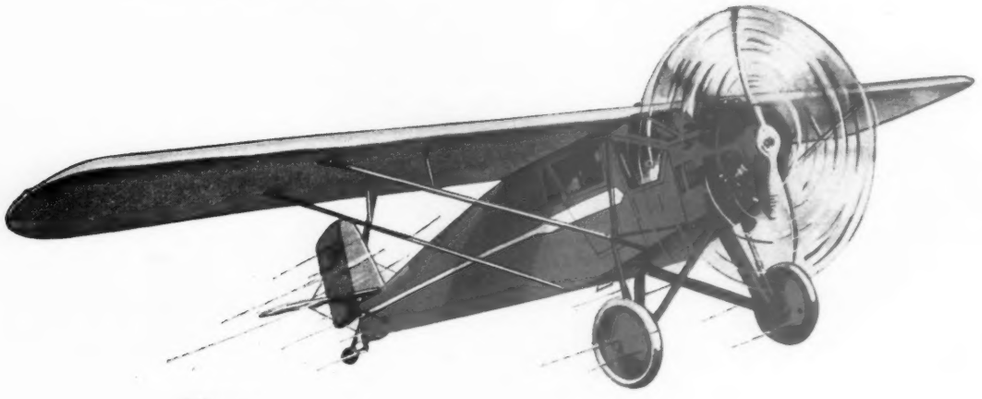

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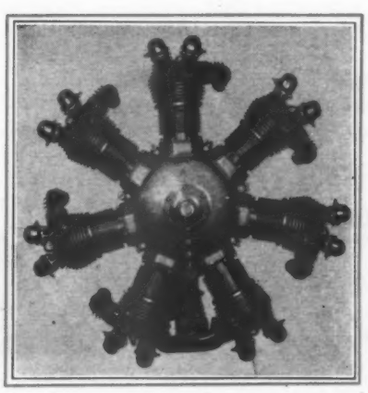

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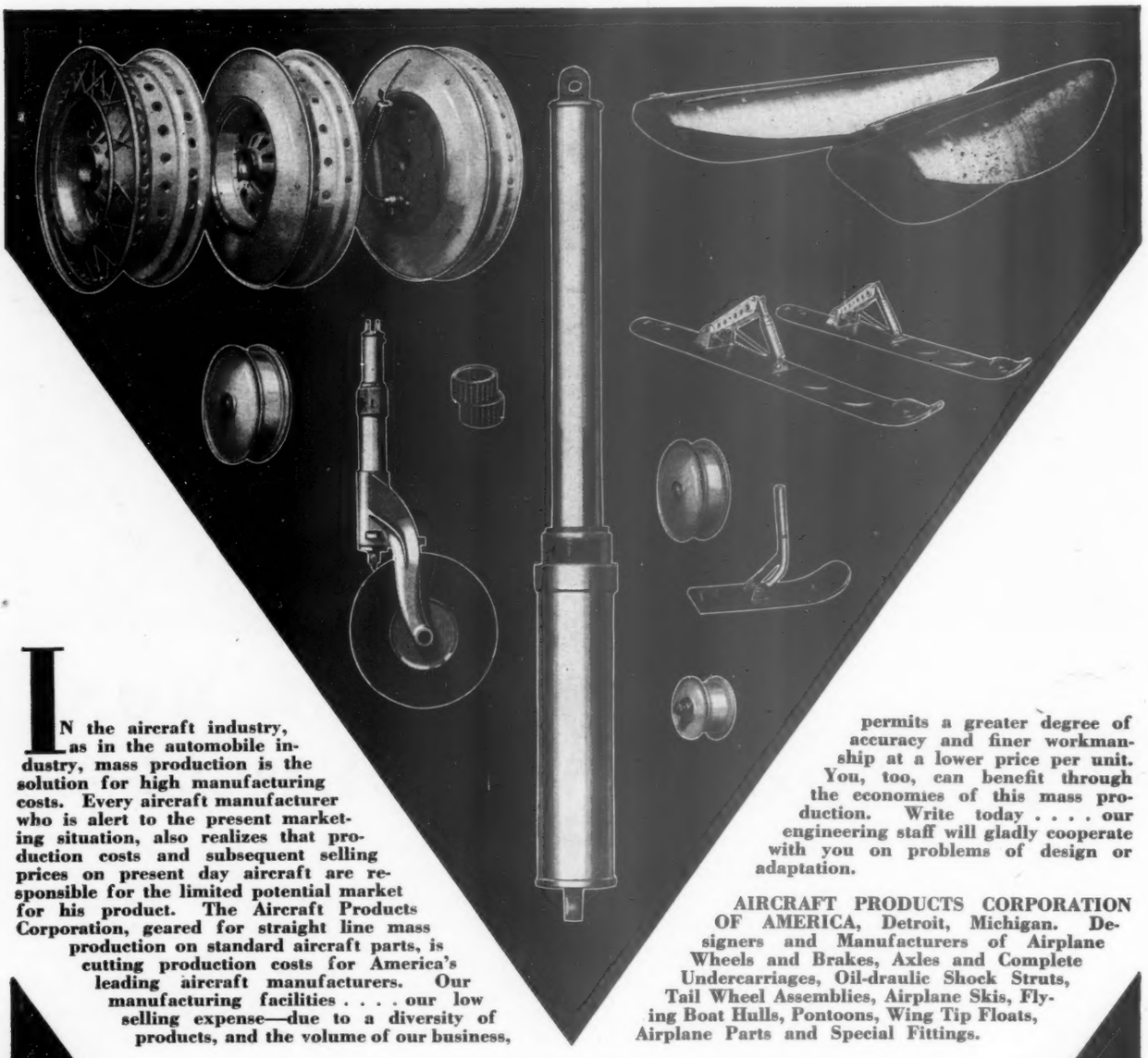

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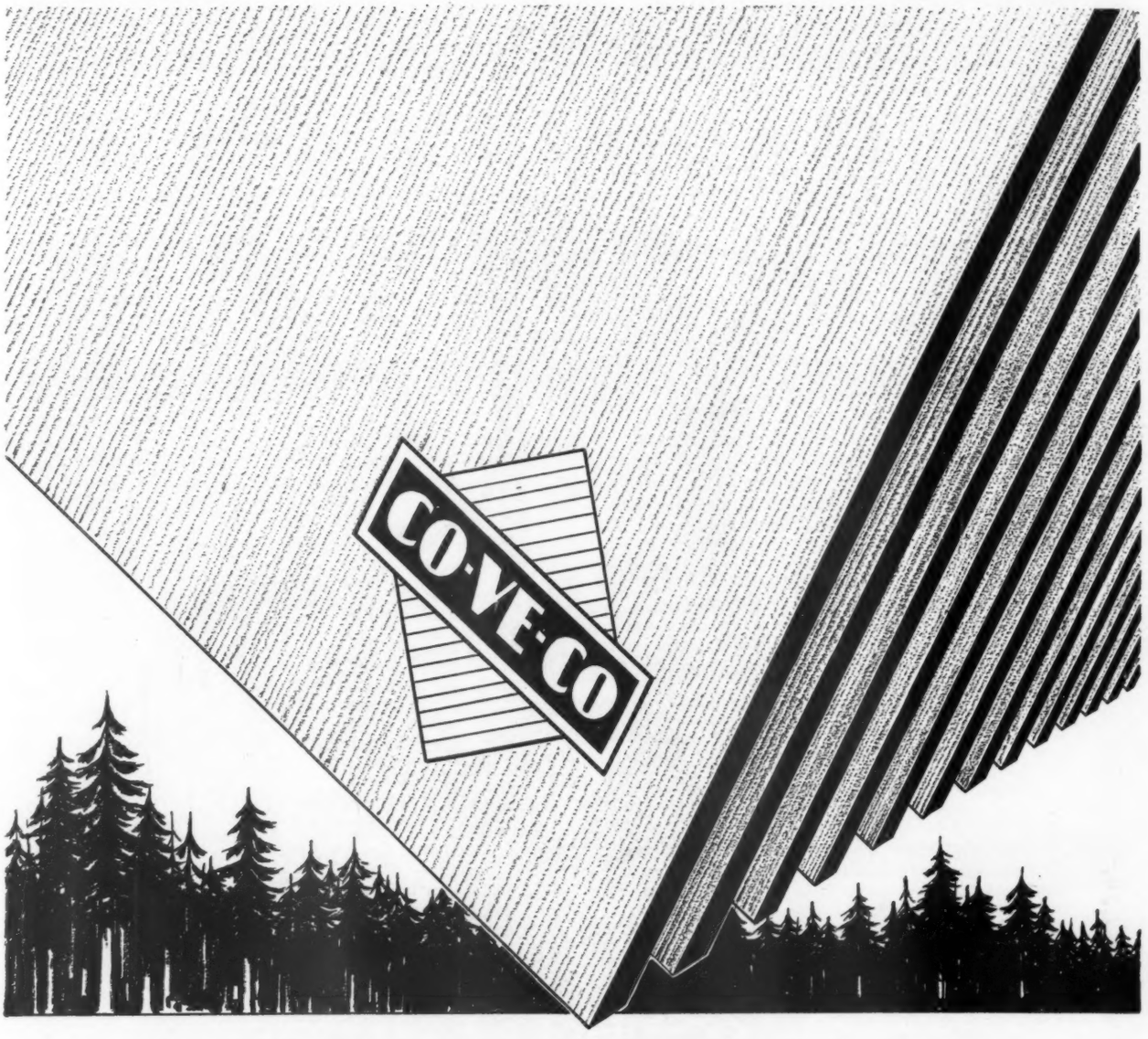

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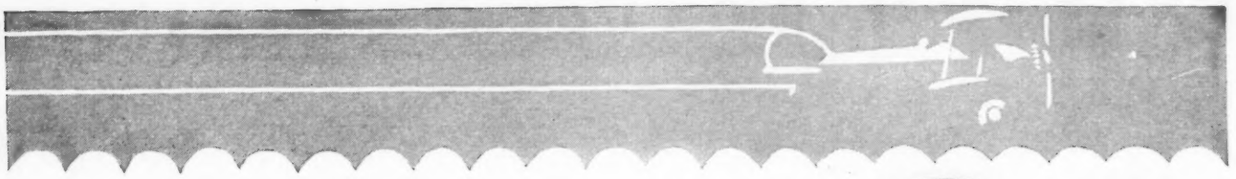

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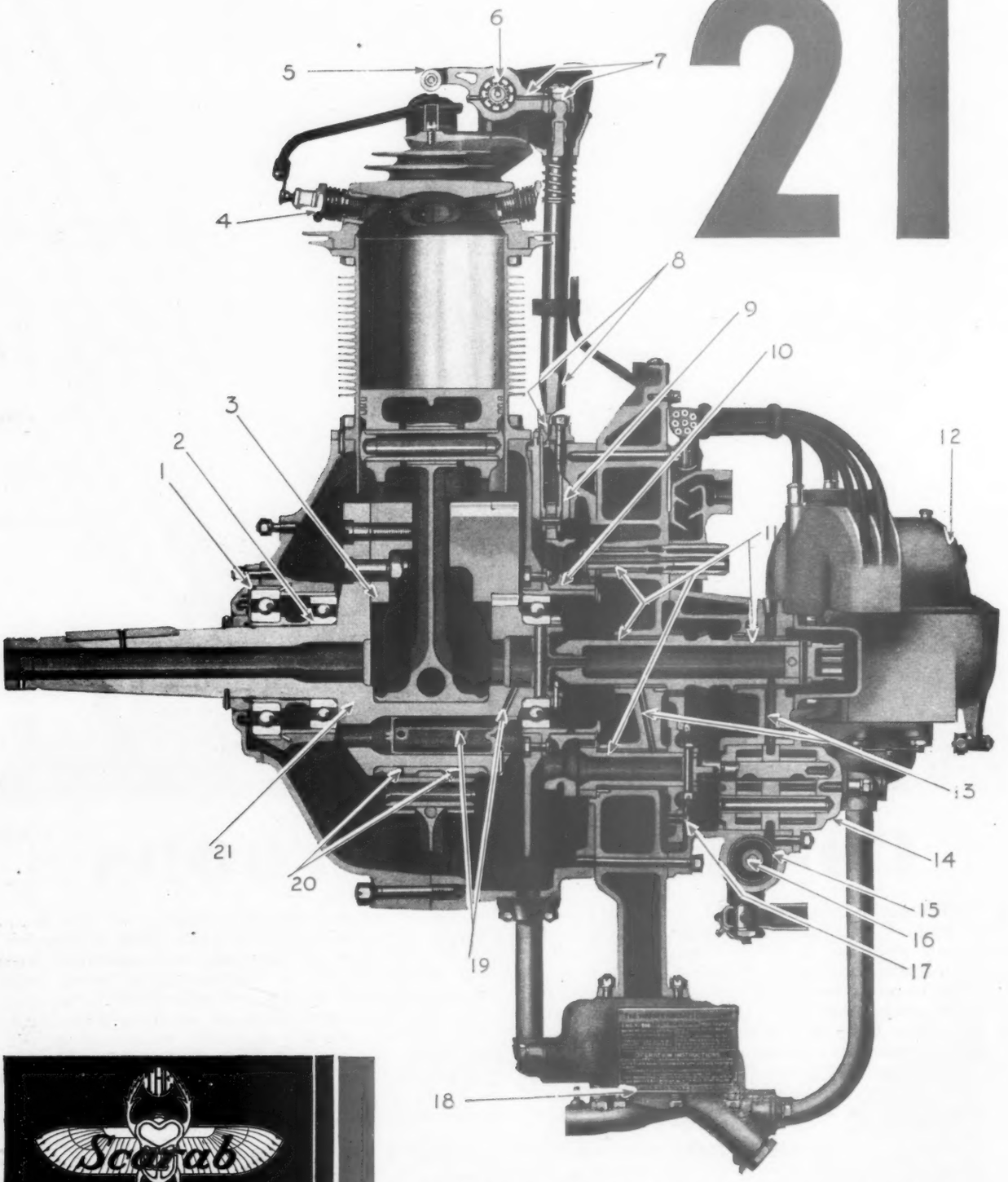

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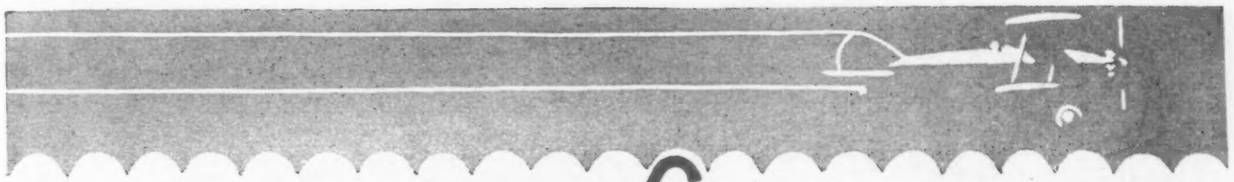

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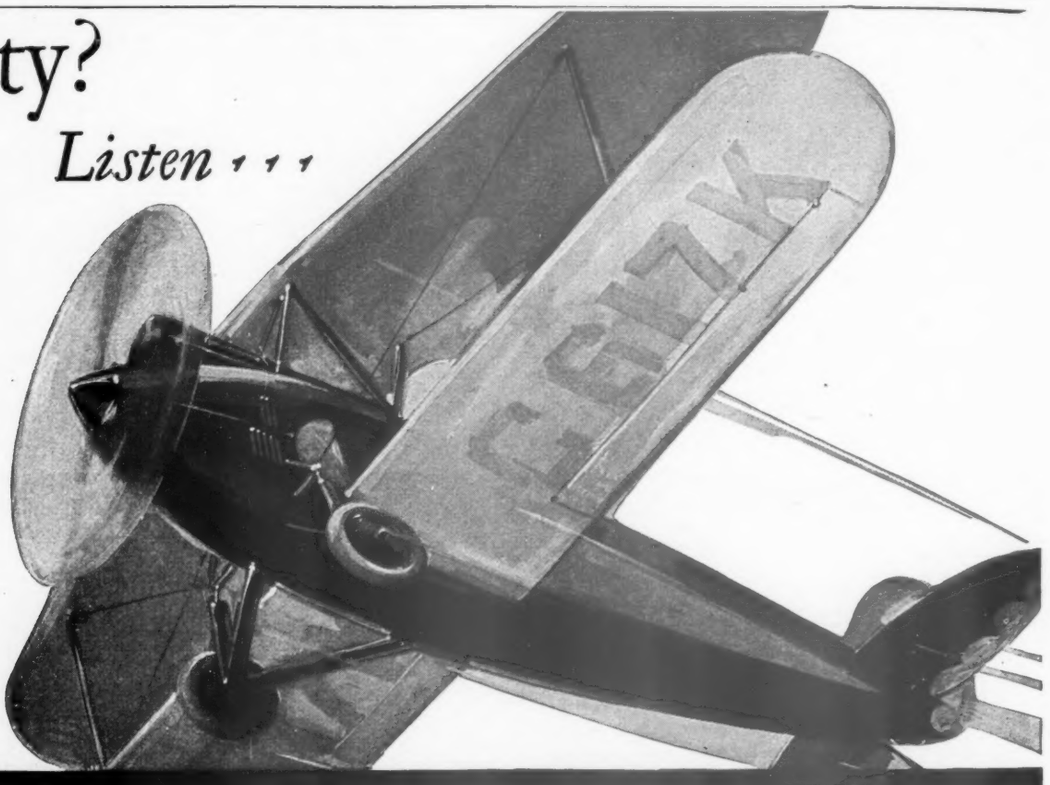

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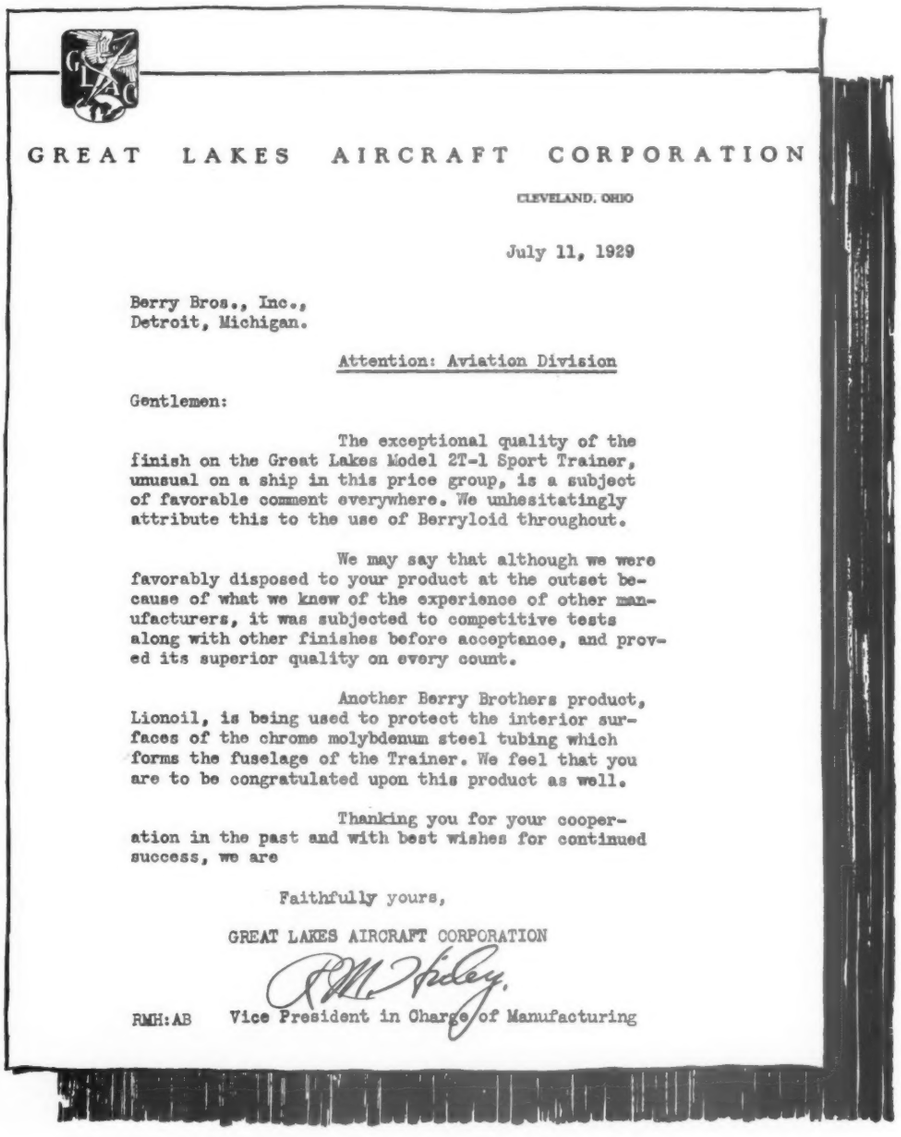

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CLEVELAND, OHIO

July 11, 1929

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Attention: Aviation Division

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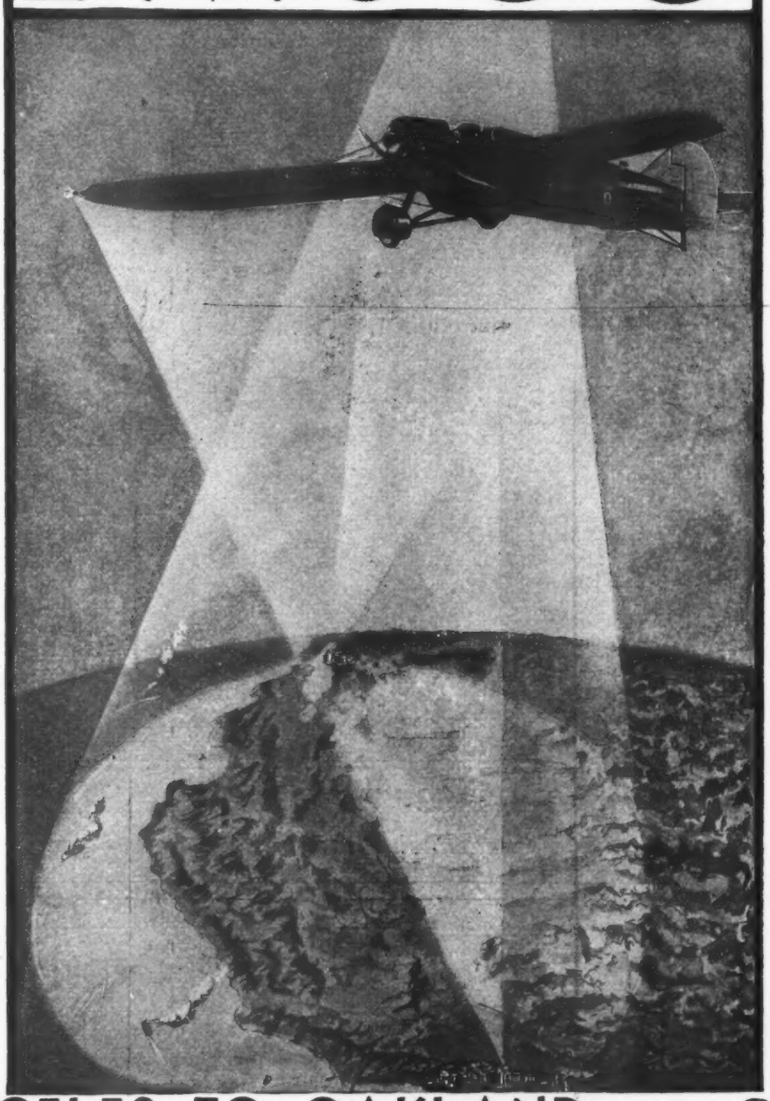
EMSCO



LOS ANGELES TO OAKLAND — GAS $4.14

Engineers and Master Craftsmen have built sturdiness into the EMSCO CIRRUS.... Innumerable times the Cirrus motor has demonstrated its dependability.... Now John Guglielmetti, former T. A. T. pilot brings us indisputable evidence of the economy of this remarkable combination of plane and motor.

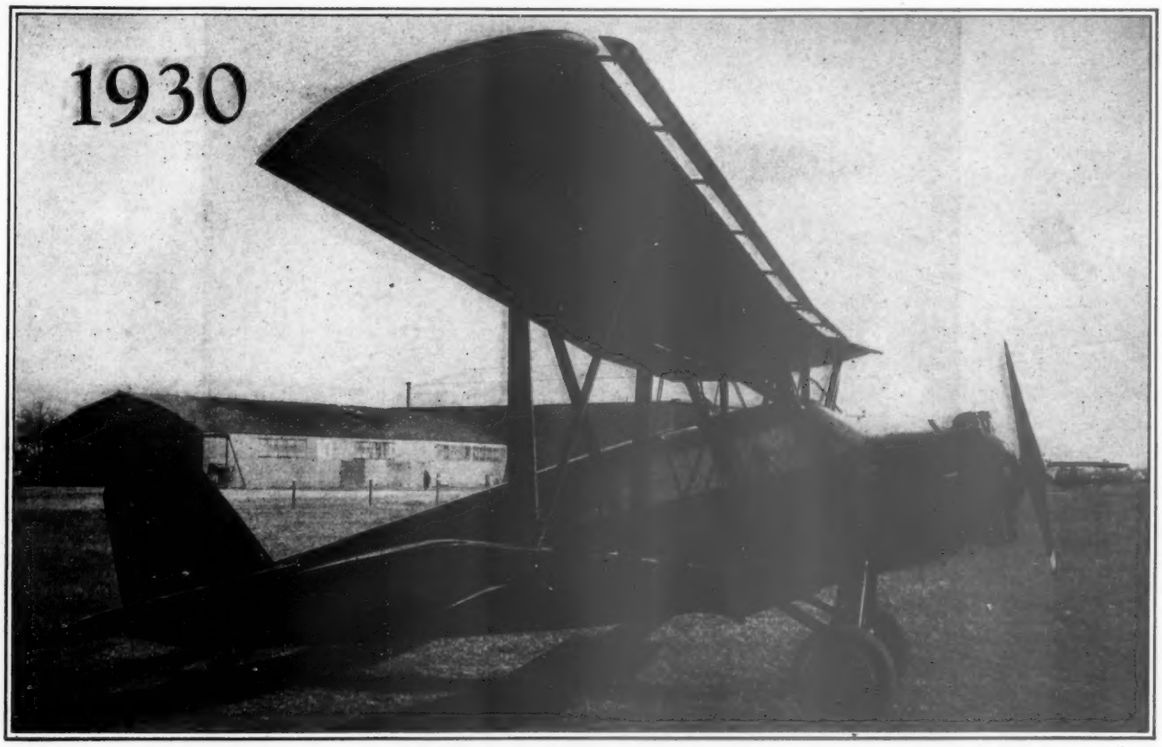
Under normal weather conditions and with little or no wind, Guglielmetti flew this husky sport and training monoplane from Downey to Oakland in three hours and 45 minutes. The airline distance is 350 miles and it took 18 gallons of gasoline to refuel the plane to its capacity of 30 gallons. That is 4.8 gallons per hour or 19.4 miles per gallon. Figure it out for yourself with aviation gasoline retailing at 23 cents per gallon.

The price of the EMSCO CIRRUS is no more than that of the finer motor cars and its ability to furnish economical transportation over great distances invites comparison. Responsible dealers will be interested in the EMSCO sales plan. Details will be forwarded on request.

EMSCO AIRCRAFT CORPORATION ◆ DOWNEY ◆ LOS ANGELES COUNTY ◆ CALIF.

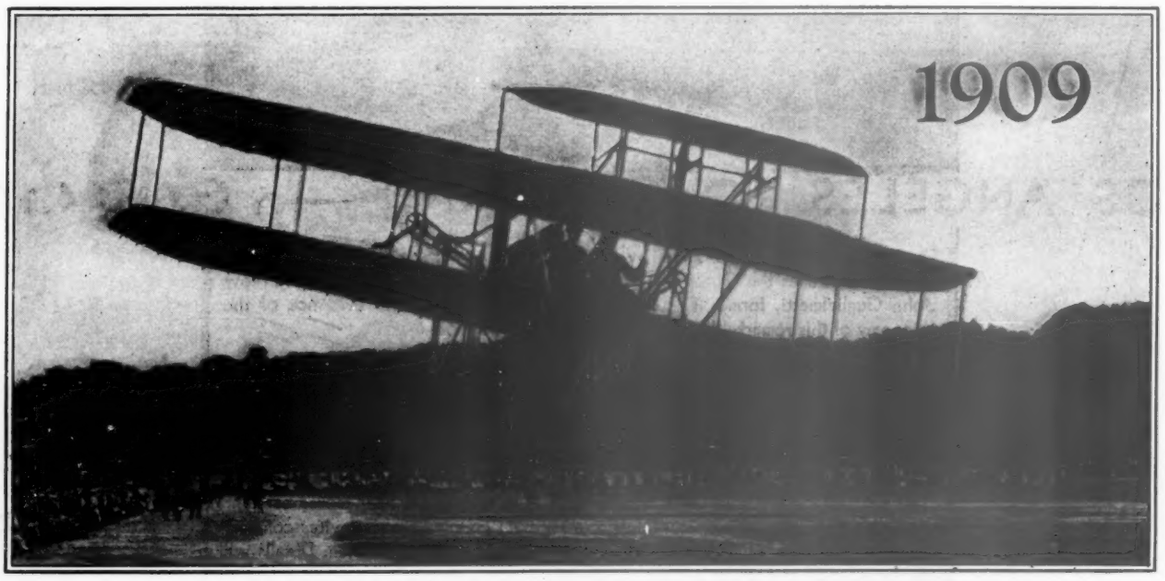
A COMPLETE LINE OF AIRCRAFT FOR LAND AND SEA

Why YOU should



CURTISS-"TANAGER"

Winner of $100,000 Guggenheim International Safety Competition



First Successful Heavier-than-Air Cross Country Flight
by* WRIGHT BI-PLANE *1909

enter AVIATION

the Curtiss-Wright Way

Curtiss-Wright developments and achievements are today bringing the air mastery of the world to America.

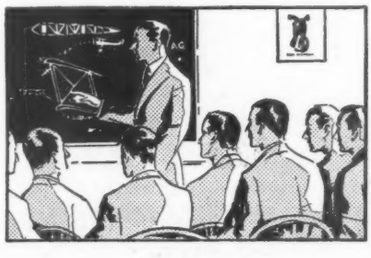
This leadership was most clearly demonstrated when the Curtiss-"Tanager" won the $100,000 Guggenheim award as the world's safest plane. This brilliant victory in international competition not only proves the ability and soundness of Curtiss-Wright engineering, but also inaugurates a new era of safety in the air. "A plane that the lay pilot could fly with satisfaction, security, efficiency and safety," was the official summary of "Tanager's" ability.

THE development of the "Tanager" is only one of the many outstanding achievements by Curtiss-Wright in the past few months. Commander Byrd flew over the South Pole in a plane with Curtiss-Wright motors. Dale Jackson and Forest O'Brien established the world's endurance record of 417 hours in a "Robin" powered with the famous Challenger motor—both Curtiss-Wright products.

The "Mystery" Ship established the record as the fastest commercial ship ever built, winning the Cleveland Air Race over a large field of entries. It was produced by Travel Air, one of the Curtiss-Wright group.

Curtiss-Wright engineers produced the "Fledgling," the world's most famous training ship.

The gigantic "Condor," the world's most luxurious transport plane, carries passengers over the T.A.T. and other airlines.



List of

CURTISS-WRIGHT

Flying Service

Bases

Atlanta, Ga.	Louisville, Ky.
Baltimore, Md.	Memphis, Tenn.
Boston, Mass.	Miami, Fla.
Bridgeport, Conn.	Milwaukee, Wis.
Buffalo, N. Y.	Moline, Ill.
Caldwell, N. J.	Oklahoma City, Okla.
Chicago, Ill.	Pittsburgh, Pa.
Cleveland, Ohio	Portland, Maine
Columbia, S. C.	Providence, R. I.
Columbus, Ohio	Raleigh, N. C.
Dallas, Texas	Rockland, Maine
Denver, Col.	San Francisco, Calif.
Detroit, Mich.	St. Louis, Mo.
Hartford, Conn.	Syracuse, N. Y.
Indianapolis, Ind.	Toledo, Ohio
Kansas City, Kan.	Valley Stream, N.Y.
Los Angeles, Calif.	Worcester, Mass.

The name Curtiss-Wright has an international prestige and means much to the graduate pilot. To have learned to fly under the guidance of Curtiss-Wright instructors is to have learned from the world's best teachers, up to the minute with every advancement in aviation.

To make it easier for you, Curtiss-Wright offers the new finance plan—a small down payment and pay the balance after you learn to fly.

Send in the coupon. Check the course you are interested in. Get the Curtiss-Wright Flying Book and complete information about the various courses and the finance plan. Make up your mind to start now. Mail the coupon at once.

Note the wide distribution of these Curtiss-Wright Ground and Flying Schools. There is one located near you.

CURTISS-WRIGHT FLYING SERVICE

MAIL THIS COUPON TODAY

CURTISS-WRIGHT FLYING SERVICE
27 West 57th Street, New York

Gentlemen: I am interested in aviation and would appreciate more information on the subjects I have marked X.

- ☐ Flight Instruction
- ☐ $50 Ground Course
- ☐ Finance Plan
- ☐ Opportunities in Aviation
- ☐ Aviation for the Business Man
- ☐ Curtiss-Wright Booklet

Name.....

Street.....

City..... *State*.....

Phone..... *Age*.....

AD-2

MOHAWK *adopts* HEYWOOD STARTER *as standard equipment*

Mohawk—the well known light, low winged monoplane has adopted the well known Heywood Starter as standard equipment on all ships.

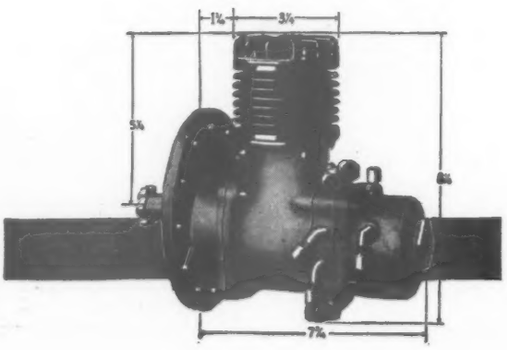
The selection of Heywood by Mohawk is in line with this company's rigid policy of choosing only the most dependable equipment on the market.

The Heywood Injection Starter has gained its splendid reputation because it starts instantly under all conditions—is light in weight—has few moving parts and is as simple in operation as in design.

There should be a Heywood on your ship. Send for complete details.

SKY SPECIALTIES CORPORATION
3651 Hart Avenue - - Detroit, Michigan

START~ER *by* HEYWOOD



KEYSTONE-LOENING AMPHIBIAN "AIR YACHT"

FOUR TIMES AROUND THE WORLD

MAKING three trips a day each way between Detroit and Cleveland, the Keystone-Loening Air Yachts of the Thompson Aeronautical Corporation flew 97,191 miles in seven months of last year—equivalent to four times around the equator.

With the waterfront bases of T. A. C. but 16 minutes from the business centers of both cities, passengers leave one and are in the heart of the other . . . 100 miles distant . . . in a scant hour and a quarter. Small wonder that T. A. C. carried a full complement of passengers on a high percentage of the 972 trips made during 1929.

In the November issue of Aeronautics, Mr. Richard (Tex) Marshall, V.-P. and General Manager of T. A. C., said, "We decided to use Keystone-Loening Amphibians because we had faith in their sturdiness, their all-around ability as flying machines and because of their excellent records made in all kinds of service." This choice was amply justified by the results T. A. C. obtained from these machines in actual service.

Keystone-Loening Amphibians are making profits possible for leading air-transport lines such as Pan-American Airways, Western Air Express, Curtiss-Wright Flying Service, American Air Express and many others. Full particulars showing the distinct advantages of the Air Yacht over other types of equipment gladly furnished on request.

6 to 8 passengers : 525 H. P. : 100 M. P. H. Cruising

KEYSTONE AIRCRAFT CORPORATION

DIVISION OF

CURTISS-WRIGHT CORPORATION

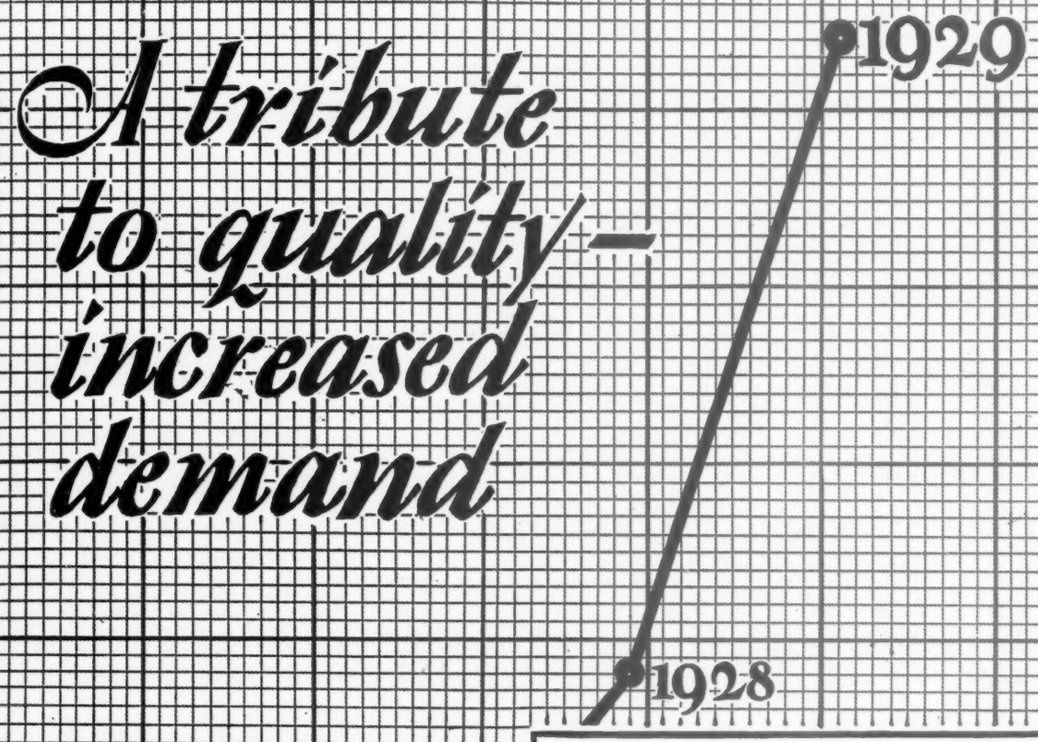
SALES OFFICES: 27 WEST 57TH STREET, NEW YORK

The 1930 model Keystone-Loening Air Yacht will be on Exhibit at St. Louis, Feb. 15th-23rd

1930 Model Air Yacht

$29,700

A tribute to quality— increased demand



MORE welds were made with Oxweld No. 1 High Test Welding Rod during 1929 than during the preceding four years combined. This phenomenal rise indicates its general recognition and acceptance by Engineering and Industry.

The reasons—

It has proved uniformly dependable.

It is made to rigid manufacturing specifications.

Each lot is checked by actual welding tests.

It assures approximately 20 per cent. greater tensile strength than mild steel rod.

If you are not already using this rod it will pay you to try it.

OXWELD
WELDING & CUTTING APPARATUS

OXWELD ACETYLENE COMPANY
Unit of Union Carbide and Carbon Corporation

NEW YORK Carbide and Carbon Bldg. — UCC — CHICAGO Carbide and Carbon Bldg.

SAN FRANCISCO: Adam Grant Building

STOCKS IN 42 CITIES

IN CANADA: Dominion Oxygen Co., Ltd., Toronto

PROFITABLE LINKS *in Air Transportation*

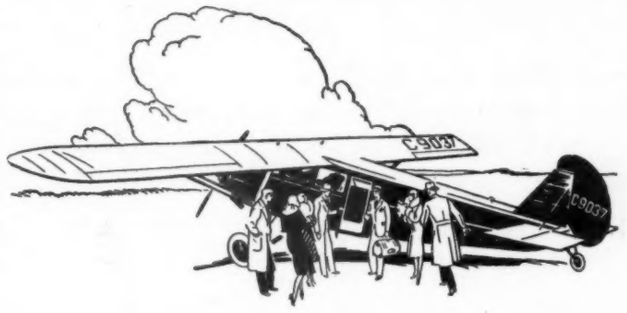
THERE is one sure way to gain better than usual profits from air transportation. Put your business on a basis of safety, speed and comfort at low operating cost—with TRAVEL AIR Six-place Cabin Monoplanes!

Throughout America there is a need for tributary air lines, to fill in the gaps between off-main-line cities and important airports on cross-continent routes. Passengers will patronize a feeder line that takes them direct to a connecting airport without the delay of transfer from train or motor bus, and long-distance travellers like to continue their journey by air from division point to destination. Such air travel truly saves time.

See Travel Air in the Curtiss-Wright Exhibit at the International Aircraft Exposition, St. Louis February 15th to 23rd.

Passenger confidence is won and held by TRAVEL AIR. Its luxurious interior provides comfort and relaxation—riding pleasure that makes boosters and brings repeat business.

From the operator's angle, TRAVEL AIR Six-place Cabin Monoplane is an ideal ship. It is extremely versatile—in local

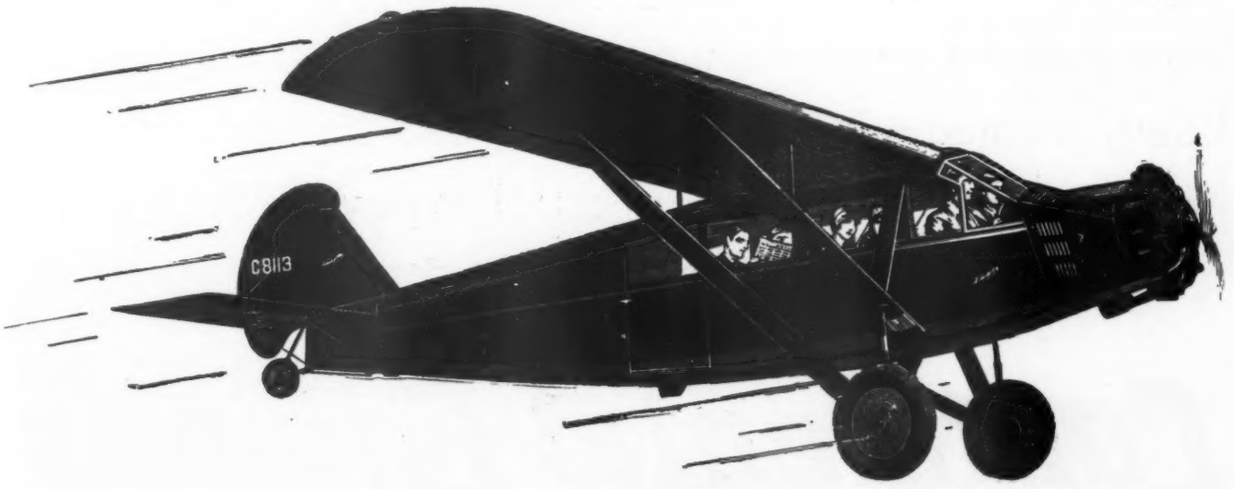


line passenger and express service, in charter for business or pleasure trips, or as a reliable means of transportation for emergency when speed is especially important.

On every good point you can think of—handsome appearance—inherent safety—easy handling—all-weather efficiency—speed that assures low passenger-mile costs—TRAVEL AIR has demonstrated its superiority.

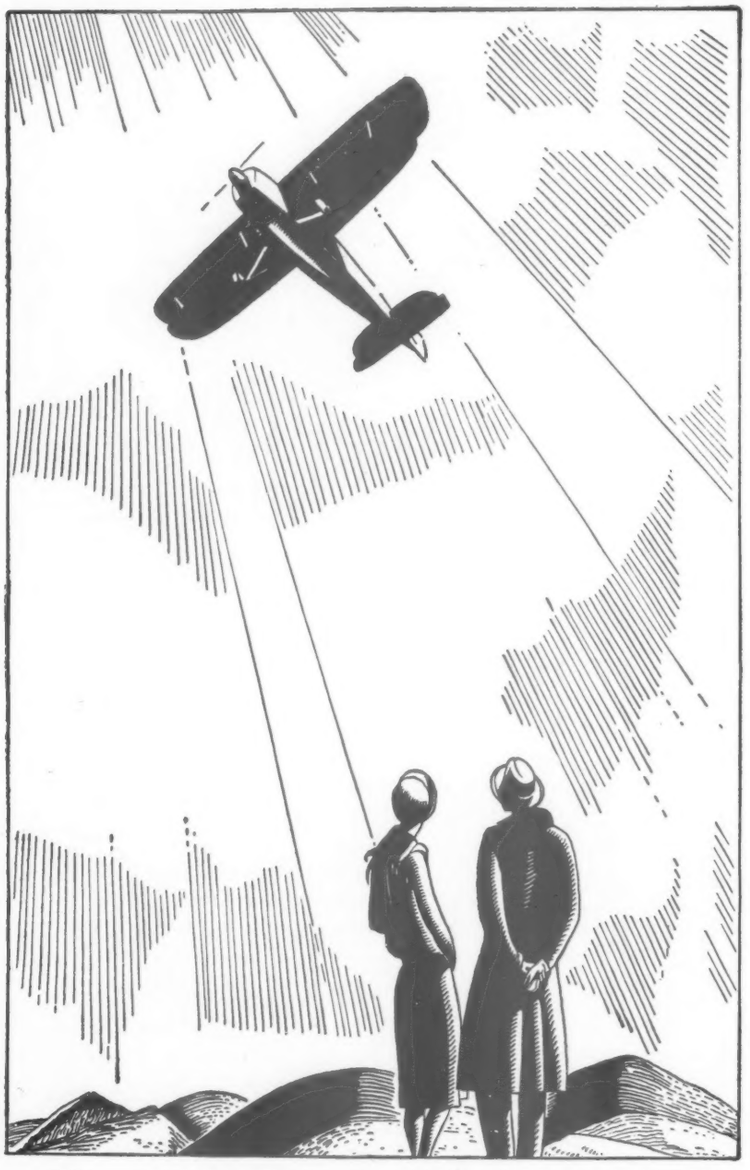
Write straight to headquarters for full information on TRAVEL AIR monoplanes for transport service and detailed statements of costs in actual operation. Address Dept. T-73.

TRAVEL AIR COMPANY
Division of **CURTISS-WRIGHT**
Sales Offices: 27 West 57th Street, New York



A PLANE FOR EVERY PURPOSE

TRAVEL AIR



When eyes turn to the sky, minds turn to Continental, for it is here that the finest developments in aircraft engines are being created—in the vast plants and laboratories that have served so many users of gasoline power for 29 years.

"Approved Type Certificate No. 32, U. S. Department of Commerce"

CONTINENTAL AIRCRAFT ENGINE CO.

General Office and Factory: Detroit, Michigan

Continental Engines

Drawing upon the facilities and experience of the greatest engine builder in the world, Continental is uniquely enabled to counsel with the trade in the design and production of engines to fit individual requirements.

EDO THANKS THE AIRCRAFT MANUFACTURERS

Bellanca "CH" 300 | Waco 10 | Aeromarine—Klemm | Consolidated—"Fleet" | Travel Air—"SB 6000"

WITHOUT the helpful cooperation of the foremost aircraft manufacturers, EDO could hardly have won its justly deserved position as the world's leading maker of civil aircraft floats. It is working hand-in-hand with the nation's greatest aeronautical engineering staffs that has enabled EDO designers and craftsmen to produce float installations that are scientifically correct in design and performance.

To these aircraft manufacturers EDO is grateful, and pledges itself to continue to produce floats as efficient, as durable and as trouble-free—just as perfect as modern aeronautical science can make them.

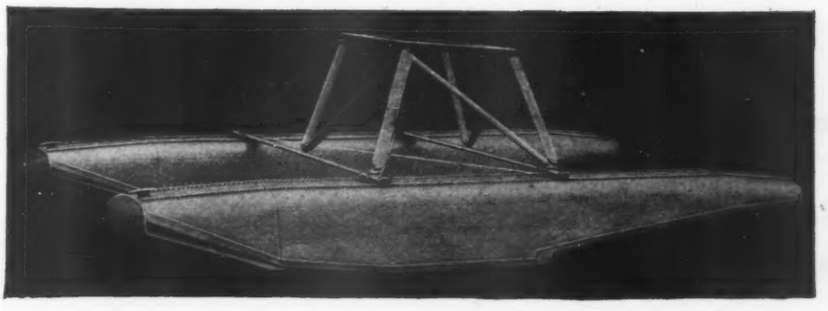
EDO Floats are now available in 11 standardized models suitable for land planes up to 8250 lbs. gross load, in accordance with U. S. Department of Commerce regulations. Already more than 40 distinct types of land planes have been EDO-equipped—with complete float installations interchangeable with the wheel landing gear. All of the planes shown on this page have been granted licenses as EDO-equipped seaplanes.

Lockheed "Vega" | Ryan "B-5" | Travel Air "SA—6000" | Curtiss Robin—Challenger Motor and Wright J-6 165 | Stinson "SM—1F"

EDO invites the cooperation of other aircraft manufacturers—and extends to them the facilities and benefits of years of experience devoted solely to the design and manufacture of floats and their attaching gear. EDO is prepared to develop and furnish complete float installations for any land plane and assures these manufacturers and their distributors unbiased protection and cooperation in developing a seaplane market for their machines.

The tested EDO Sales Plan has proved a wonderful profit-builder—and enables manufacturers and dealers to cash in on the tremendous and ever-growing demand for convertible—land or sea—planes. For particulars about EDO floats, and details of the EDO Sales Plan, address EDO Aircraft Corp., 600 Second Street, College Point, L. I.

Travel Air S 4 D and S B C—4000 | Stearman C-3 B | "Gipsy Moth" | Commandaire 5-C-3 and 3-C-3 A | Travel Air "S E 4000" and 2000



EDO

THE **FLOAT** MAKERS

With infinite Care and Skill <<<

GOOD airplane steels cannot be supplied from stock. Rather, they must be specially developed, and manufactured with infinite care and skill, in accordance with the exact nature of the task involved. Throughout the special department which Bethlehem devotes to the manufacture of "Airplane Quality" Steels and Forgings this principle is held as fundamental. It is a governing factor in Bethlehem's success in meeting the requirements of the aeronautical industry.

Bethlehem's experience in developing and manufacturing steels and forgings for builders of aircraft engines dates from the beginning of the aeronautical industry. Many of the greatest flights in the history of aviation were made by planes with Bethlehem "Airplane Quality" Steels and Forgings in vital parts of their engines.

To the aircraft engine builder, Bethlehem offers steels of proved reliability—plus the services of an organization that is fully equipped and eager to cooperate with him, and in position to draw on a vast reservoir of experience in the development and manufacture of "Airplane Quality" Steels and Forgings.

With the aim of developing still stronger and better steels to meet the future needs of aviation and other industries, continuous research and experimental work is carried on in Bethlehem laboratories.

>> *Make it a point to see the Bethlehem Exhibit at the International Aircraft Exposition, St. Louis, February 15-23, booths 61 and 62.*

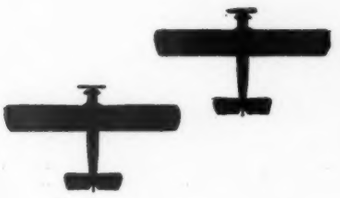
BETHLEHEM STEEL COMPANY, *General Offices: Bethlehem, Pa.*

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu.

BETHLEHEM

"AIRPLANE QUALITY" STEELS *and* FORGINGS



Only two

out of 1730 prospects were "too busy" to see this *flying* representative!

A NEW product to sell . . . the largest and most up-to-date hotel in New York City. Hundreds of prospects to be seen . . . located in 60 cities in every part of the country. Only one man available . . . and a 15,000 mile trip to be made in 60 days!

Obviously older transportation methods—the railroad or automobile—were far too slow. There was only one way to cover the ground, and that was to *leave* it. A Curtiss Robin was chosen. The trip was made—through sun and rain, storm and cold—without a hitch.

This was a carefully planned sales campaign. Letters were written to leading bankers, department stores, travel agencies and hotel managers—1730 in all. They were told when Mr. H. Stevens, Assistant Manager of the New Yorker Hotel, would be in their city. Only two of the 1730 prospects were "too busy" to see the man who had such an important message that he flew all the way from New York to deliver it. Even if these personal calls had not been made, this "flying" trip would have paid for itself three times over in publicity values alone!

An unusual case? Not at all. Large enterprises now regard the airplane as essential business equipment—as the nearest thing to having a man in two places at the same time. And every day more and more sales managers are turning to the Curtiss Robin for those important "flying" trips that must be made.

With more than 40 strategically-located airports of the Curtiss-Wright Flying Service, and distributors practically everywhere, the reliable service that keeps planes in perfect condition—by Curtiss-trained mechanicians—is never more than an hour or two away.

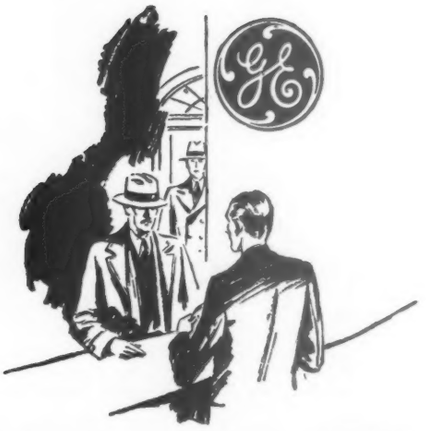
There's a definite need for a Curtiss Robin in every line of business—ways in which it might be used to increase sales and profits. For particulars as to how a Robin might best serve you, address Dept. R-73.

THE HOTEL NEW YORKER

CURTISS-ROBERTSON AIRPLANE MFG. CO.
Division of **CURTISS-WRIGHT CORPORATION**
Sales Offices: 27 West 57th Street, New York City

CURTISS ROBIN

For Business
Pleasure
Training



CONFIDENCE
BUILT ON
Constructive principles

You can do business with confidence when you buy of the General Electric Supply Corporation.

Our prices are definitely established.

Our merchandise is of sound design, material and construction.

Our salesmen are helpful counselors.

The product and service that we offer make buying a profitable action on your part.

The reputation of General Electric products becomes daily more and more enviable. A billion advertisements feature them each year

—to serve better the electrical needs of America

—the public accepts them ever more readily—a majority of the American people already own and use equipment bearing the familiar G-E monogram.

The General Electric Supply Corporation supports the General Electric policy of constructive development for the industry and for the public it serves. With any one of our 81 Houses, *you* can do business with confidence. If you have an electrical need *—write!*

Join us in the General Electric Hour, broadcast every Saturday night at 9 p. m. Eastern Standard Time over a nation-wide N. B. C. network.

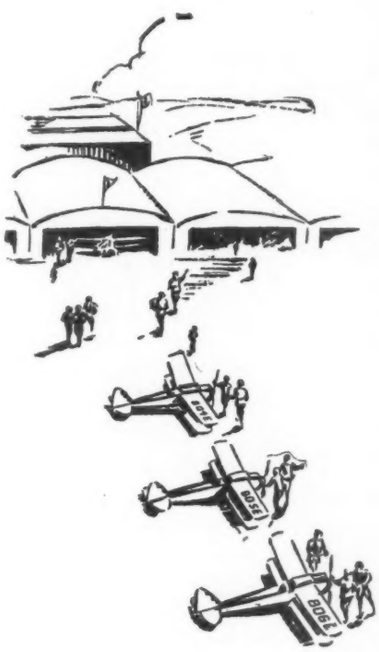
GENERAL ELECTRIC
SUPPLY CORPORATION
GENERAL OFFICES BRIDGEPORT, CONNECTICUT

Call to mind every feature of design, construction and performance that you ever visioned as the ideal training plane. You'll find them all to perfection in the

for schools..

D. H. GYPSY MOTH

Instruction's Greatest Ally—Ambition's Kindest Friend



TRIM of line, sturdy of construction, powered with the reliable Wright-Gypsy engine, tested and found true in more than 10,000,000 miles of flying under every condition and circumstance, Moth planes are ideal for quick, safe, thorough training service.

Among the outstanding features of the Moth are—aero-dynamic stability so complete that the ship practically flys itself—extreme immunity to stalls through Handley-Page slotted wings and D. H. differential ailerons—generous control surfaces, harmonized to give instant, easy and smooth response to the pilot's touch—steel-tube fuselage and wide, split-axle undercarriage to withstand the severe shocks of inexperienced landings—structural factors of safety far above strains of the most extreme acrobatic flying—telephone system to permit normal voice in conversation or instruction. The Moth possesses many other extraordinary refinements that have received the approval of famous engineers and pilots.

See D. H. Gypsy Moth in the Curtiss-Wright Exhibit at the International Aircraft Exposition, St. Louis, February 15-23.

In a business era when economy is counted as profit, the Moth affords remarkably low cost of operation. The gasoline consumption approximates 18-20 miles to the gallon—about equal to that of the average automobile; oil consumption correspondingly small.

Rugged structural strength of plane and efficient simplicity of engine brings a welcome freedom from constant repairs and replacements.

These are facts. There are others that will interest you as greatly. Write today for Gypsy Moth records of achievement, statement of performance, figures of actual operating cost. Address Dept. M-73.

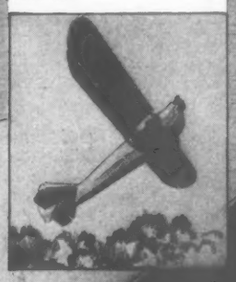
MOTH AIRCRAFT CORPORATION
Division of CURTISS-WRIGHT
Sales Offices: 27 West 57th Street, New York

D.H. Gipsy MOTH

Announcing

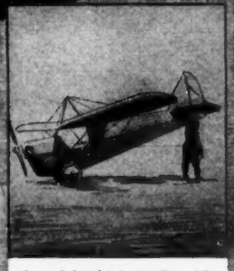
The Most Remarkable Plane in Aviation History

The Aeronca C-2 opens a new era in aviation. Its design and construction is the result of courage and vision on the part of its creators. All precedents and tendencies were forgotten in the desire to build a plane which is far lower in initial cost and cheaper to operate than any automobile . . . a plane which the average man can fly safely and own proudly.



A steep take-off after a 5-second run. Unusual design and remarkable aerodynamic efficiency make this maneuver easy . . . and safe.

Gliding 32 miles with a dead stick. From 16,500 feet, the Aeronca will glide to any spot in a circle 200 miles in circumference.



Its weight of only 400 lbs. with gas and oil permits easy handling . . . during spectacular maneuvers aloft or in hauling about on the ground.

The Aeronca C-2 is the result of 3 years study, development and intensive testing. Unparalleled combinations of wing span and power loading provide as great an inherent degree of safety as it is possible to attain in any airplane. Its motor is just as unique and conforms exactly to the aerodynamic principles of the plane itself. It develops 30 H. P. at 2500 R.P.M. on 2 gallons of gasoline an hour. And an hour at cruising speed means 65 to 70 miles.

The Aeronca C-2 is the answer to aviation's greatest needs. Student fliers can cut their training costs in half; sportsmen can at last enjoy the pleasure of infinite freedom and the thrill of whistling wind and speed in their own plane; flying clubs can buy and operate their plane at a very low figure; aviation schools can reduce their fees and double and treble their enrollment. In short, the Aeronca C-2 is what the country has been waiting for . . . the first absolutely safe, practical and economical light airplane.

AERONCA

Jean A. Roche', Senior Aeronautical Engineer of the U. S. Army Air Corps, designed the Aeronca C-2 and its special motor.

The Aeronca C-2 is built in its own factory. The entire plane . . . except instruments and tires . . . is under direct control of the manufacturer. *There is only one profit.* The production of every part is certified . . . which means that every Aeronca C-2 is assured of a superiority in design, style, finish, performance, dependability and economy. All in all, the Aeronca C-2 is a value far in excess of any plane on the market today. For further details, write immediately.

AERONAUTICAL CORPORATION OF AMERICA

LUNKEN AIRPORT • • • • • • • • • • CINCINNATI, OHIO

1930 - -
and what of the Future -

Possibly not in 1930 but reasonably soon "Travel by Air" will be one of the customary means of transportation.

Mail development already is great—Expressage is next in order. These will be followed by Air Travel as a matter of course.

The busy man, by use of Aeroplanes, can accomplish four times as much in getting about the World as he can now by other means at hand, fine though they are. Air Traveling does not displace other lines of transportation. It adds a new field of untold possibilities. Few in the Aviation Industry are competent to picture its future.

THIS COMPANY LOOKS FORWARD WITH CONFIDENCE TO 1930. The record established in 1928 and 1929 will probably be maintained.

The other lines of industry served, and there are many, show great promise of still further development. New lines are waiting to be served.

We have established ourselves in International trade.

S. L. GABEL, President

Summerill Tubing Company

BRIDGEPORT, PENNA.

TRAVEL BY AIR
U.S. AIRWAYS

At St. Louis Show
Booths 143-144

TUBING by SUMMERILL

SINCE 1899

When You're Flying for *Pleasure*—

Sit Side-by-Side in an Inland Sport!

COMPARING pioneer automobiles with today's cars, an outstanding difference is the degree of *comfort* afforded driver and passenger. Similarly, the Inland Sport brings greater comfort and pleasure to flying. The side-by-side seating arrangement in a roomy cockpit makes the Inland Sport "tomorrow's plane today."

Pilot and passenger can talk face-to-face in ordinary tones, even while flying at high speed. They can discuss their maps, consult one another about landmarks, point out the "sights" en route, converse as they would in a motor car. Sport flying thus becomes as pleasant, as chummy and as intimate as motoring in a sleek sport roadster—*plus* all the thrills of the air!

The Inland Sport is built for air-minded sportsmen . . . for you ex-service flyers who still hanker for the feel of a stick . . . for use by owner-pilots in business . . . and for schools. This high-wing, two-seater ship is the ideal training 'plane because of its side-by-side seating arrangement.

Sturdily built, the Inland Sport has the strength and ruggedness to withstand hard usage. It is economical to own . . . economical to operate. Powered with a LeBlond 60 or Warner Scarab engine, this small, low-price sport 'plane has few equals in refinement of design, beauty of line and color, performance and reliability.

Further details gladly sent on request.

INLAND SPORT

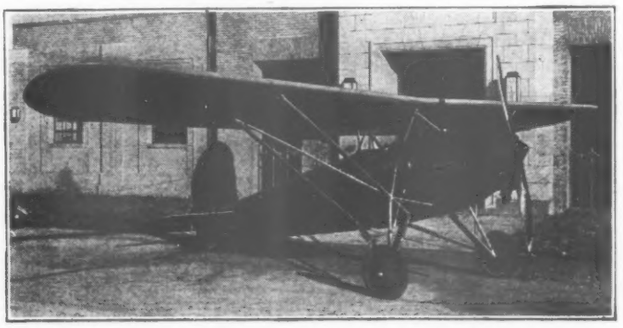
INLAND AVIATION COMPANY

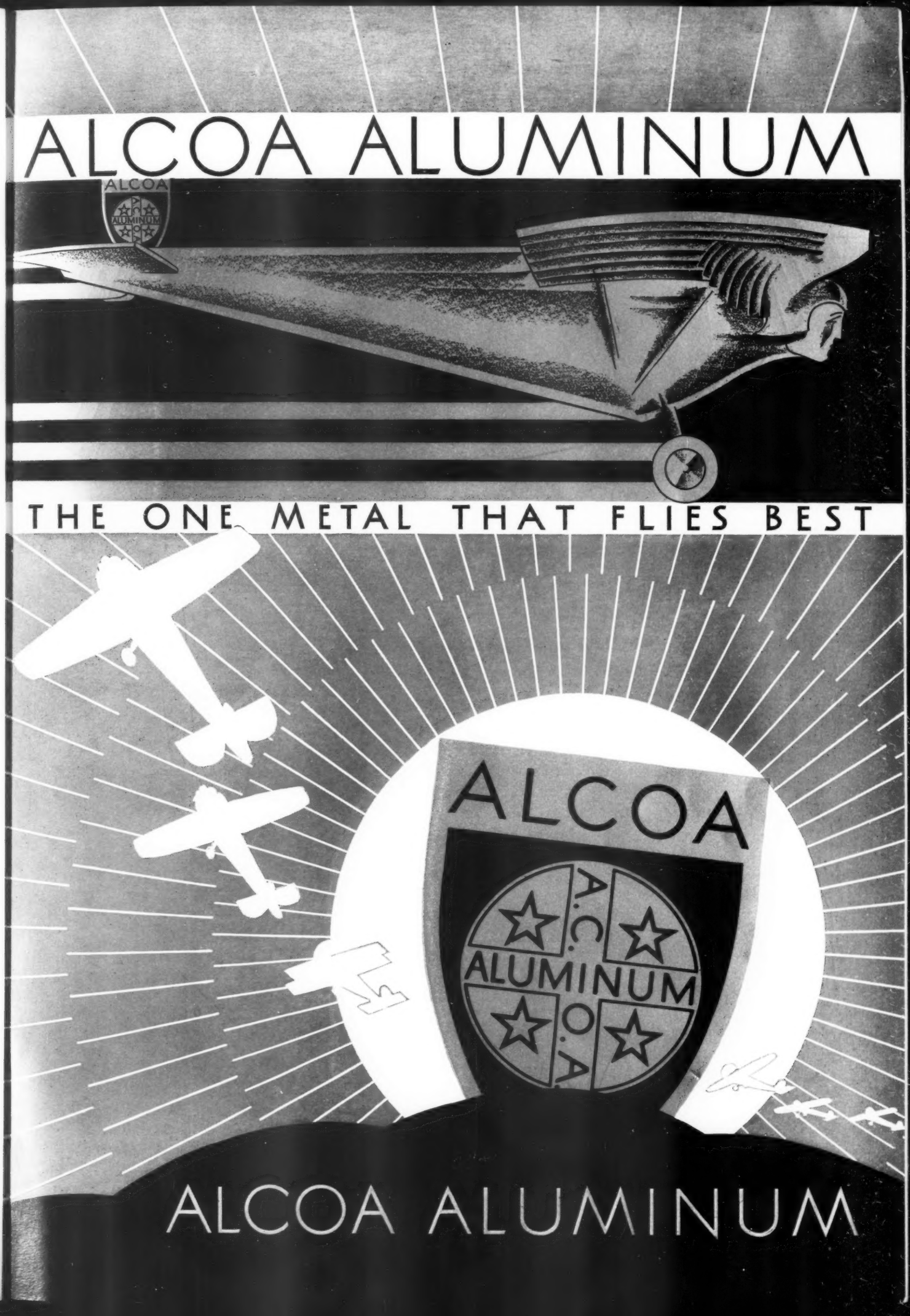
Fairfax Field
KANSAS CITY, KAN.

INLAND SPORT MONOPLANE

"TOMORROW'S PLANE TODAY"

Manufactured at Fairfax Field under Approved Type Certificate No. 259




ALCOA ALUMINUM
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THE ONE METAL THAT FLIES BEST
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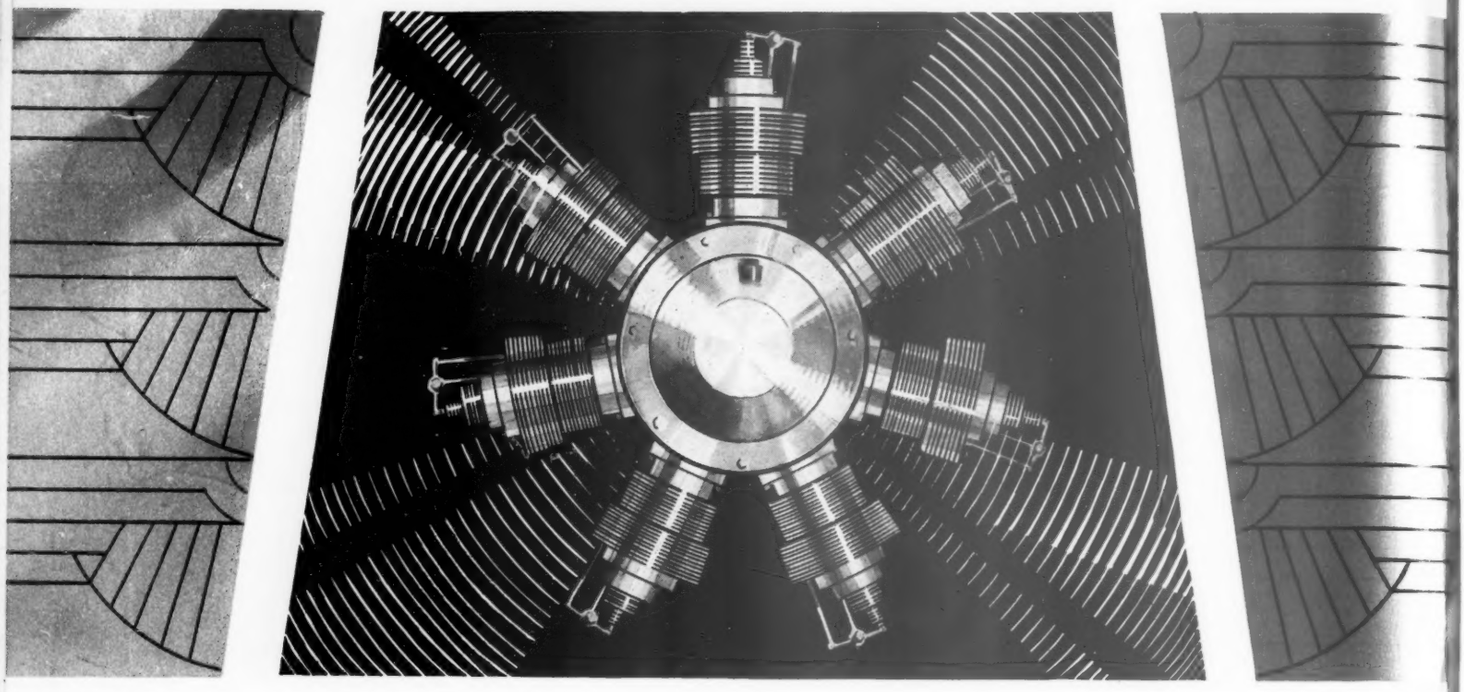
THE ONE METAL THAT FLIES BEST



FOR OVER 400 HOURS AN ALCOA ALUMINUM PROPELLER KEPT A CURTISS-ROBIN ALOFT

Droning through the Missouri sky for over 400 hours, the Curtiss-Robin world endurance record-holder was held aloft by an Alcoa Aluminum propeller. More than two weeks of continuous whirling, without a sign of strain, is unique tribute to the fatigue life of Alcoa Aluminum.

In propellers forged of Alcoa Aluminum great strength is combined with extreme lightness. Although the Alloys of Alcoa Aluminum weigh but 1/3 as much as old-fashioned metals, when heat treated they attain a tensile strength equal to many heavy commercial steels—55,000 pounds per square inch minimum.

More than 60 parts for airplanes are now being forged of Alcoa Aluminum. They are highly resistant to corrosion. They are tough. They are easy and cheap to machine. They take a high polish, which often saves expensive plating.

Technical Data Which Gives Definite Proof that Alcoa Aluminum Is the One Metal that Flies Best.

Material	Specific Gravity	Young's Modulus of Elasticity lbs. per sq. in.	Ultimate Tensile strength lbs. per sq. in.	Yield Point lbs. per sq. in.	Fatigue Limit lbs. per sq. in.	Specific Tensile Strength [1]	Specific Yield Limit [1]	Specific Fatigue Limit [1]
Alcoa Aluminum 17ST	2.8	10,000,000	58,000	35,000	15,000	20,710	12,500	5,360
Chrome-molybdenum steel	7.9	30,000,000	100,000	60,000	40,000	12,650	7,600	5,060

[1] The specific tensile strength, specific yield point, and specific fatigue limit are equal to ultimate tensile strength, yield point and fatigue limit divided by the specific gravity

Our nearest office will gladly send a representative to explain exactly how Alcoa Aluminum can be used to meet your construction problems. He will be a technical man, competent to assist in solving metallurgical problems. ALUMINUM COMPANY *of* AMERICA; 2482 Oliver Building, PITTSBURGH, PENNSYLVANIA. Offices in 19 Principal American Cities.

ALCOA ALUMINUM

9-58

COMING SOON!

Another WACO . . . priced still lower and offering characteristic WACO value and performance . . . soon will be ready. Look for it at the St. Louis show.

Doing 5 things *better*

The Five Factors that won for WACO the last two National Air Tours are responsible for WACO popularity and sales

BY consistently doing five things better than any other American airplane, WACO won two successive National Air Tours . . . in 1928 and 1929 . . . by commanding leads.

Last October, WACO was awarded the highest "Figure of Merit" as a result of the formula tests which decided the all-'round performance of each competing plane.

This formula, agreed upon by the Contest Committee of the National Aeronautic Association as being fair and impartial to all entries, is made up of the following five factors:

1. *Useful Load:* The *greater* the useful load a ship can carry, the higher its figure of merit becomes . . . for obvious reasons.

2. *Speed:* The *faster* a ship can travel with full load, the higher its figure of merit . . . because its practical utility is thereby improved.

3. *Landing Time:* The *shorter* the distance in which a ship comes to a dead stop, the higher its figure of merit . . . because its capability in emergency landings is greater.

4. *Take-Off Time:* The *quicker* a ship leaves the ground, the higher its figure of merit . . . because of its greater ability to get out of small fields.

5. *Power:* The *less* power a ship requires to do all these things, the higher its figure of merit . . . because its operation is more economical.

These five factors by which a ship is judged are directly responsible for WACO popularity and sales. Today, more WACOS are in commercial service than any other make!

THE WACO AIRCRAFT COMPANY, Troy, Ohio

WACO AIRPLANES

"Ask any Pilot"

The Ford Reliability Trophy and its 1929 winner, John Livingston. Read the book containing his own story of the Tour. Also read the new WACO "225" booklet which gives full descriptive details of this great airplane. Write for your copies today.

The winning WACO's official figures in the 1929 Ford Tour

With Dept. of Commerce type certificate loading of 972 pounds . . . with average top speed of 135.4 m.p.h. clocked four times over a measured course . . . with the astonishing time of 3.4 seconds to dead stop in landing . . . with correspondingly abrupt take-off time of 4.4 seconds . . . and powered by the Wright J-6, 7-cylinder, 225 h.p. motor . . . WACO outperformed the pick of the nation's airplanes, regardless of size, type, or price. By its magnificent performance throughout the Tour . . . its *perfect score* for every one of the 32 laps, totaling 5,017 miles . . . the WACO "225" has proved its right to rank with the greatest airplanes ever built.

An Announcement to the Aviation Industry

REALIZING that the empirical period in the manufacture of aircraft is past—and that the Aviation Industry is now going forward on a production basis

WE ANNOUNCE the establishment of a new service facility—The Aviation Service Division of The Linde Air Products Company.

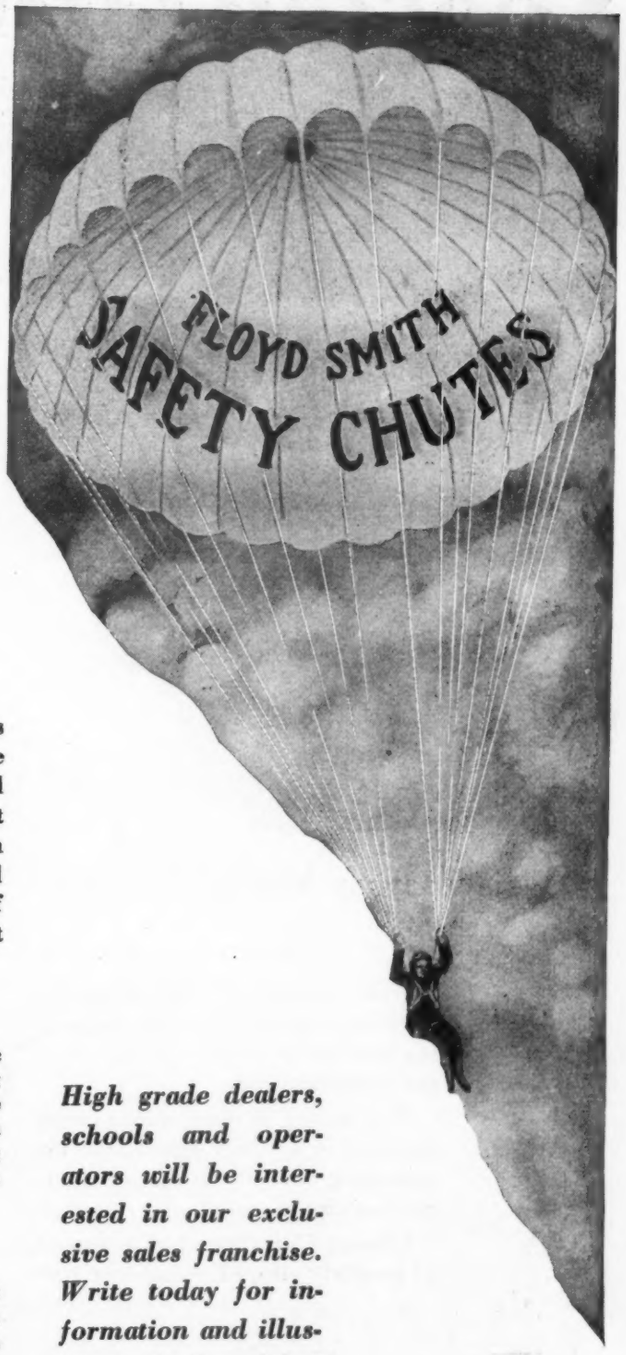
THE PURPOSE of this division is to co-operate with and advise the Aviation Industry on the efficient application of oxy-acetylene welding to its production requirements—duplicating in this industry a facility largely responsible for the economic success of the oxy-acetylene process in the whole industrial field.

The Linde Air Products Company
The Prest-O-Lite Company, Incorporated
Oxweld Acetylene Company—Union Carbide Sales Company
Manufacturers of supplies and equipment for oxy-acetylene welding and cutting.
UNITS OF
UNION CARBIDE & CARBON CORPORATION
30 East 42nd Street UCC New York, N. Y.
and all principal cities

65 Linde Plants—48 Prest-O-Lite plants—174 Oxygen Warehouse stocks—156 Acetylene Warehouse stocks—42 Apparatus Warehouse stocks—245 Carbide Warehouse stocks

ACCLAIMED!

The Greatest Aerial Life Saving Devices In the World



From all over the country flyers have written us saying they believe the Floyd Smith Safety Chute and Seat the greatest and most practical Aerial Life Saving devices in the world today. Not just another chute, but an entirely new departure in parachute construction, eliminating all "If's" and "perhaps'" and developed by the Daddy of Parachutes from years of experience, to meet modern flying conditions.

THE MANUALLY OPERATED PACK

Smaller, lighter, more compact—no flaps—no elastic bands—no frail wire pilot—no vital parts exposed—nothing to get out of order, it is simplicity itself. A single cable fastener gives a triple positive opening action direct from the rip . . . a pull and out shoots the pack cover acting as pilot and instantly the main chute blossoms; not a chance of blanketing under any circumstance.

THE SAFETY SEAT

This is the first practical life saving device for transport and cabin planes. A comfortable upholstered seat in appearance, in a moment it can be turned into a positive life saving device whereby twenty passengers can be dropped through the bottom of the transport in as many seconds to float safely to earth, without a passenger moving from his or her seat.

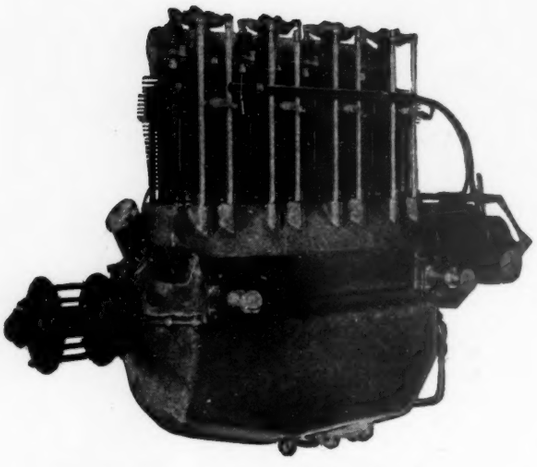
High grade dealers, schools and operators will be interested in our exclusive sales franchise. Write today for information and illustrated booklet "COMING DOWN".

Manufactured by

SWITLIK MANUFACTURING CO.

TRENTON : : : : : : : : NEW JERSEY

Specialization . . .



Wright Gypsy Motor

Cheney Cast Cylinder barrel used in the Wright Gypsy.

Well organized manufacturing calls for specialized knowledge in the production of parts of the product manufactured.

The casting of the airplane motor cylinder is a highly specialized undertaking not only in casting methods but also in metallurgic research.

Cheney Cast Cylinders are made of properly alloyed nickel-iron having a finer grain, a uniform and improved hardness, free from carbide hard spots. We can furnish castings in the rough, or machined cylinders ready for assembly, direct from your blue prints.

Our twenty-five years' experience in the making of air-cooled cylinders is available to any responsible motor manufacturer.

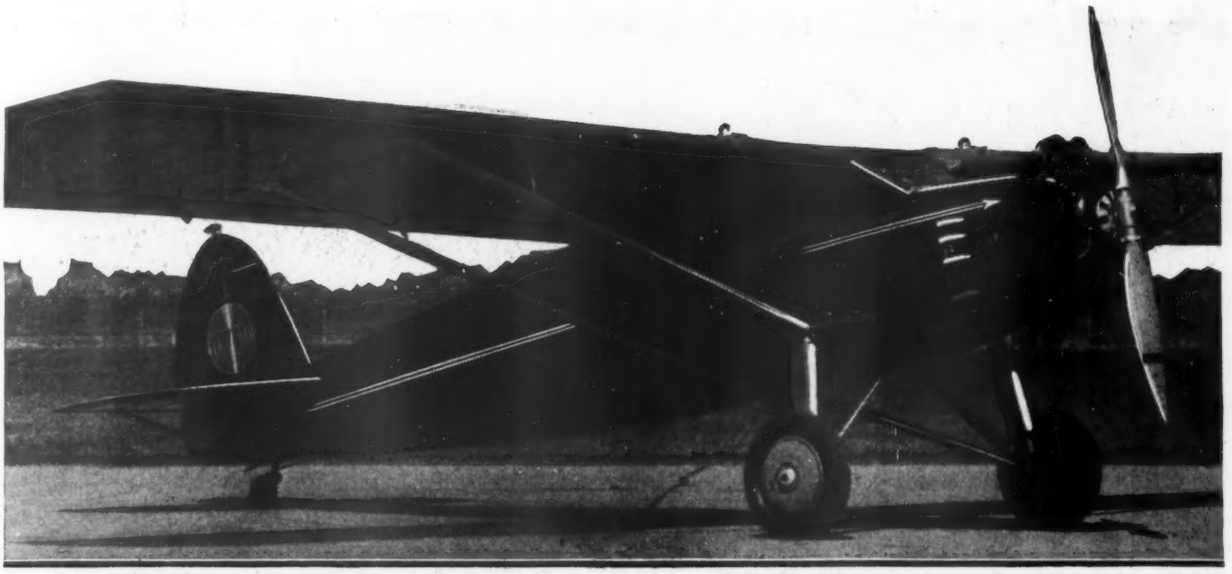
AIR COOLED CYLINDERS

S. Cheney and Son

MANLIUS, N.Y.

CHENEY ~ CAST ~ CYLINDERS

High Strength ~ Low Cost



U. S. Department of Commerce Approved Type Certificate No. 267

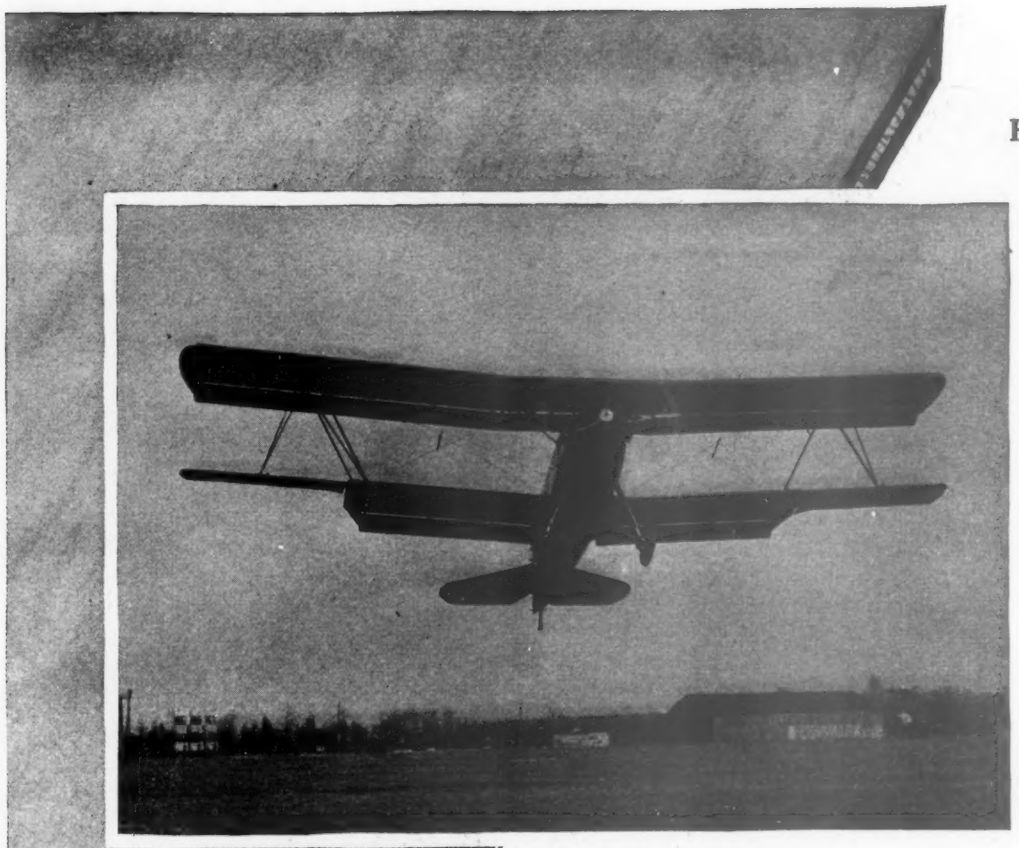
Again Verville Displays Greater Refinement in Design and Appointment

The Verville for 1930 is truly the "Limousine of the Air." Unquestionably the finest engineered, richest appointed, most beautifully finished airplane the industry has yet produced, the Verville instantly inspires a pride of ownership in all who demand the fullest measure of safety, comfort, and convenience for their guests. To discriminating sportsmen who appreciate luxury, distinctiveness and fine craftsmanship, the Verville reveals a new mode of aircraft no less beautiful in line and appointment than the finer motor vehicles of today. You are cordially invited to inspect this masterpiece of a world famous designer at the International Aircraft Exposition, St. Louis, February 15th to 23rd — or write for illustrated booklet.

VERVILLE AIRCRAFT COMPANY
DETROIT, MICHIGAN

Verville

FINER AIRCRAFT



Curtiss
and
HASKELITE
again teamed
in the
Tanager
Guggenheim
Prize-Winner

PLYWOOD
HASKELITE
PLYMETL

FOOL PROOF

Foolproofness in a plane depends on materials as well as design.

The winner of the recent Guggenheim international safe aircraft competition — the Curtiss Tanager — is an exclusive user of HASKELITE, the blood-albumin plywood. Engineering data on this outstanding material sent on request.

HASKELITE
MANUFACTURING CORPORATION
120 South La Salle St., Chicago, Ill.

Railway & Power Engineering Corp., Ltd.
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A2-15Gray

Booth 202. International Aircraft Exposition, St. Louis

SPEED - SAFETY - COMFORT - ECONOMY

The Buhl line of Airsedans is created on the soundest business fundamentals of flying. Absolute safety is paramount; comfort and economy in both purchase price and operating cost are emphasized to the greatest extent consistent with safety; speed is a variable factor depending upon the choice of engine. Here is the ideal choice for "this business up above."

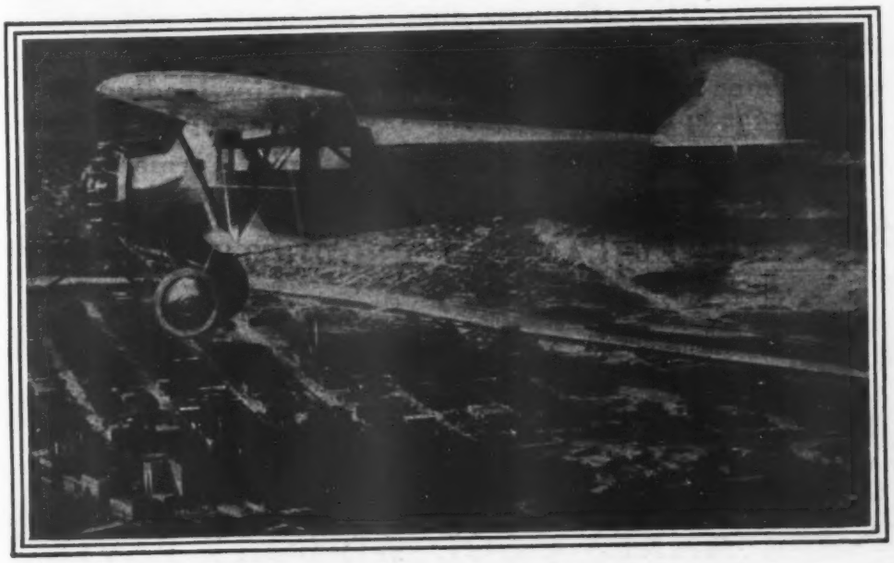
LEFT—The Buhl Senior Airsedan is an eight-place dual-control plane, priced at $18,500 with the Wasp engine and $19,500 with the Hornet or Cyclone.

. . . .

Buhl Airsedans are writing many chapters in the history of the sky. Their most recent and most outstanding achievement was completed on August 21, 1929, when the Sun God (Buhl Standard Airsedan No. CA-6-42) finished the first round trip, non-stop, refueling flight from coast to coast—Spokane to New York and back again more than seven thousand two hundred miles under every conceivable weather condition.

LEFT—The Buhl Standard Airsedan is a six-place, dual-control plane, priced at $13,500 with the J-6 Wright Whirlwind engine.

. . . .



Such remarkable records of endurance, speed, safety and economy as have been achieved by Buhl Airsedans must surely be considered in determining your choice of a plane.

LEFT—The Buhl Sport Airsedan is a three-place, dual-control plane priced at $12,000 with the J-6 Wright Whirlwind engine and $11,000 with the J-5.

BUHL AIRCRAFT CO.
MARYSVILLE : : MICH.

Buhl
Air—Sedans
SENIOR·STANDARD·SPORT

Landing on a New Tarmac Runway Surface

2 Hours and 40 Minutes AFTER IT WAS FINISHED

Tarmac's function is to keep airports in operation as continuously as possible . . . to make them provide service and produce revenue, in spite of weather, climate and conditions of the ground.

True to that mission, Tarmac does not interfere with the operation of the airport even during the construction of the runways.

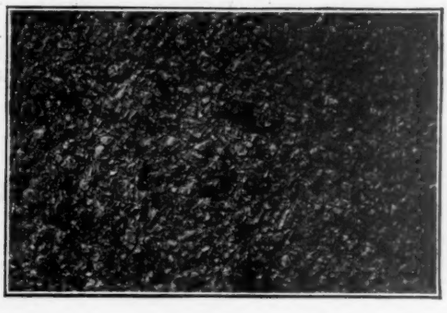
The illustration shows a section of runway surface at Bettis Field (Curtiss-Wright) near Pittsburgh, with a plane landing almost immediately after the workmen had finished the job.

Tarmac airport surfaces make landings safer and take-offs quicker. They eliminate dust in dry weather and mud in wet weather.

Tarmac is used for runways and taxi strips, landing strips, hangar aprons and for roadways leading up to airports.

Write for information on how to build Tarmac airport surfaces at low cost.

Close-up of a Tarmac surface, showing its granular, skidproof, impervious nature.



AMERICAN TAR PRODUCTS COMPANY
Division of THE KOPPERS COMPANY *General Offices:* **PITTSBURGH, PA.**

Plants:

Chicago, Ill.	Hamilton, O.	St. Louis, Mo.	St. Paul, Minn.
Follansbee, W. Va.	Utica, N. Y.	Birmingham, Ala.	Youngstown, O.
New Haven, Conn.	Milwaukee, Wis.	Providence, R. I.	Kearny, N. J.

Tarmac

MAKES GOOD AIRPORT PAVING

FOKKER FACTS—I

THE NEW F-32 SLEEPS 16 PASSENGERS

THE FOKKER F-32 is the largest plane built in America. Its wing spread is 99 feet. It carries 30 passengers by day, and sixteen by night. Powered by four Pratt & Whitney 575 h.p. Hornet engines, its high speed is 140 m. p. h. and its cruising speed 120 m. p. h.

This giant Fokker airplane was evolved by the manufacturer who has built more planes than any other man or organization on earth, the manufacturer whose planes have made twice as many world-famous flights as any other make of plane, and whose planes have flown over 25,000,000 miles on American transport lines, establishing a record for dependability that has never been approached.

This plane was designed and built with the same surety and skill that pilots and transport executives have come to expect in every one of the ten models now produced by the affiliation of Fokker and General Motors Corporation.

Because of the useful carrying capacity—low operating cost, economical maintenance and low initial investment, Fokker planes are today making it possible for air transport companies to compete with rail transportation at a profit.

For the use of business executives, for pleasure, and for transport use, Fokker now makes ten different models of airplanes: single and multi-engined types, land planes, sea planes, flying boats, amphibians. Requests for information or demonstration are invited, and will be promptly answered. Fokker Aircraft Corporation, General Motors Building, New York.

FOKKER

AFFILIATED WITH GENERAL MOTORS CORPORATION

SAFE HARNESS

SUPPORTS YOU IN COMFORT—

While you glide gently to earth in an Irvin Air Chute, you are in the same comfortable sitting position you would assume in a swing.

THE harness of an Irvin Air Chute is readily adjusted to fit the largest or smallest person, and is made of a specially woven linen webbing of 3000 pounds tensile strength. It is re-enforced on all metal parts. These metal parts consist of the snaps and adapter buckles used in securing the harness and adjusting it for size. They are chrome nickel steel with a tensile strength well over 5000 pounds, and are either galvanized or cadmium plated.

Careful attention to details creates a strength that follows through to every part of an Irvin Air Chute.

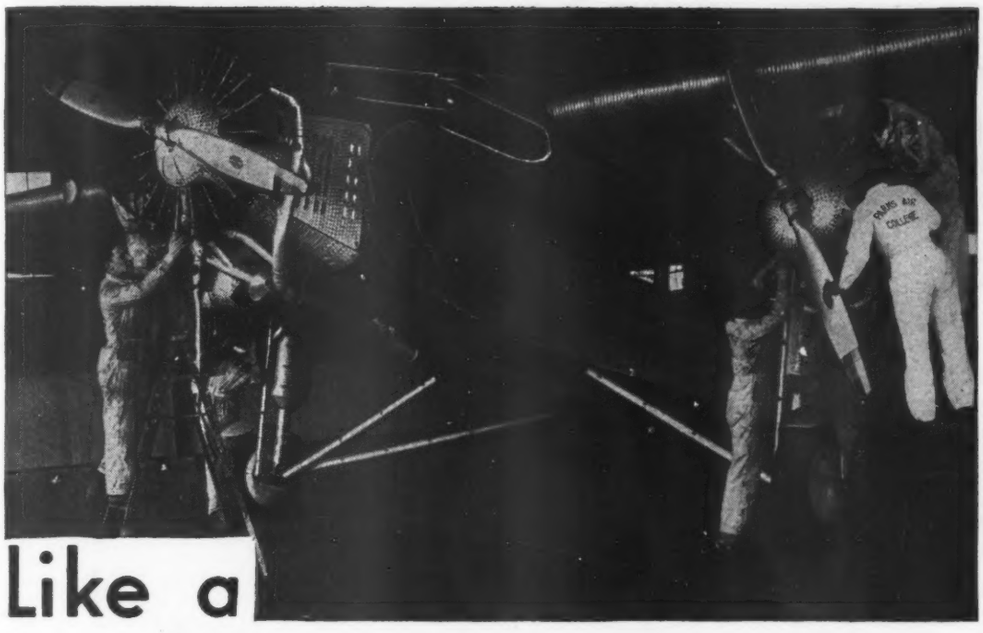
Irvin Air Chutes are available in all sections of the country. Among the important distributors are Curtiss-Wright Flying Service, Colonial Flying Service, Air Associates, Inc., Nicholas-Beasley Airplane Company, Cleveland Institute of Aviation, Cleveland, Ohio; Pittsburgh Aircraft Agency Corporation, Pittsburgh, Pa.; Ludington Philadelphia Flying Service, Philadelphia, Pa.; Motor Equipment Company, Wichita, Kan.; Walter M. Murphy Co., Los Angeles, Cal.; Aero Corporation of California, Los Angeles, Cal.; Southern Equipment Co., San Antonio, Texas; C. T. Stork Corporation, New York, N. Y., and Mid-West Aviation Corp., Omaha, Nebr.

Dealers who are interested should communicate directly with the company. If there are no dealers near you, write to us and we will arrange the most convenient way to supply your needs.

IRVIN *The Life Preserver of the AIR*

IRVING AIR CHUTE CO., INC., 372 PEARL STREET, BUFFALO, N. Y.

Our Motion Picture "Happy Landings" on standard width film, illustrating actual operation of the Irvin Air Chute is available free of charge to schools, clubs and organizations interested in aviation. Send for booklet and particulars.

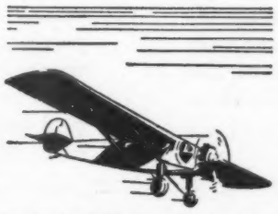


The illustration at the left shows a group of students in Parks Airplane and Engine Mechanics School receiving instructions on the new tri-motored Ford monoplane which has recently been added to the Parks fleet of more than 30 planes of varying size and type.

Like a University Degree

A DIPLOMA from the Airplane and Engine Mechanics School of Parks Air College brings you immediate returns. It is proof positive of your ability. For the aeronautical industry knows *by gratifying experience* that Parks-trained mechanics are experts—thoroughly competent to handle any job in the factory or on the flying line. The Parks course for mechanics is unequalled anywhere in the world, just as Parks flying courses are without a peer. Every subject is taught systematically—*thoroughly*—conscientiously. Every operation, from the fabrication of metal fittings to the building of wings and fuselages and the assembly of new airplanes, is performed under the supervision of instructors such as only a great institution like Parks can obtain—and with the *finest and most elaborate machinery money can buy.*

Every Parks course, too, is under the close personal supervision of Oliver L. Parks, whose fame as unquestioned leader in the field of aviation instruction is international. That is another reason why *Parks* training means *best* training—why a diploma from Parks gives the same definite prestige to its holder as a university degree.



Parks Air College was one of the first to be licensed by the U. S. Department of Commerce as a fully accredited transport school.

In its affiliations, too, Parks Air College offers its graduates more opportunity for employment than any other training school in America. As a division of the Detroit Aircraft Corporation it is a member of an organization that includes five of the finest aircraft factories in America. They are manned—and will continue to be manned—by Parks mechanics! Another assurance of the future of the Parks-trained man!

You, too, can be a Parks graduate. You, too, can know the success that comes with the *finest training in the world.* The coupon on this page will bring to you the fullest information about Parks and its courses.

Get it in the mail RIGHT NOW—and we shall send you "The Man Who Tunes the Plane", a vivid, interesting picture of the mechanic's highly profitable place in aviation.

Don't forget the coupon is your ticket to a new viewpoint on aviation—to an hour of absorbing reading—to success in the newest, most fascinating and best paying of the world's great industries.

PARKS AIR COLLEGE
(Division of Detroit Aircraft Corporation)
283 Missouri Theatre Building
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Without cost or obligation to me, please mail your illustrated catalog.

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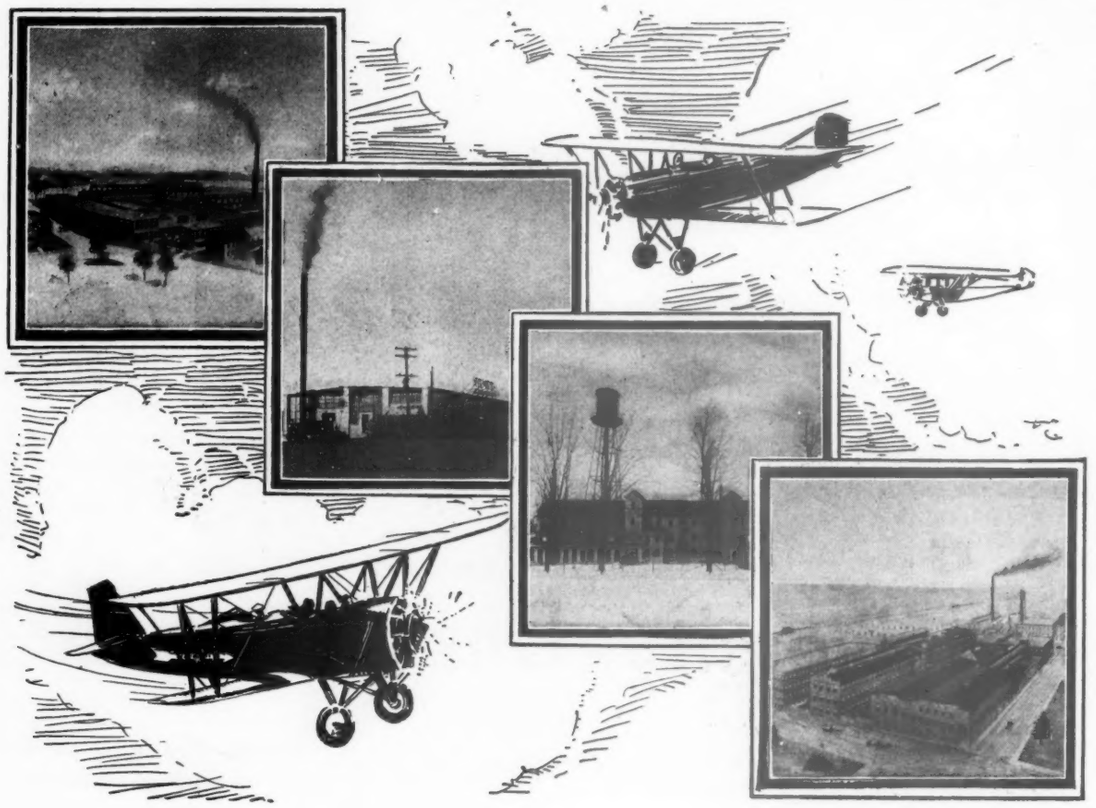

FELT

for every aeronautical requirement

The felt washer — gasket — window strip, small parts perhaps, concealed from view but nevertheless playing a significant part in the perfect operation of the plane. How important therefore is their quality, accuracy of dimension and durabilty.

The Felters Company, manufacturers of the finest felt in the world, can give you the type of product you want. Furthermore, they can, with their experts in every branch, help solve your Felt problems and assist you in cutting costs and improving production.

Blue prints — specifications — samples; send us one or all of them. We will then submit quotations and advise you of any savings that might be effected.

The FELTERS Co.

Manufacturers of Felt

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★

BUSINESS MEN ARE CHOOSING

STEARMANS

★ Watch Fenestra and the other Stearman owners during 1930

UNDOUBTEDLY a tribute to Stearman—the fact that aggressive business men, such as Mr. A. W. Sowdon of Fenestra (The Detroit Steel Products Co.), chose a Stearman for his 1930 business task. For business, the Stearman is well suited. All pilots say so, too—short landings, quick take-offs—climbs nicely with a heavy load. Just a matter of a few hours—for a trip from Dallas out to the oil wells—from the factory (Detroit) to a hot prospect in Des Moines—from Mexico City to Laredo—from New York across the Sound to New Haven—Stearman is the choice. Business Speedster or Junior Speedmail series is adaptable to sport or commercial flight. Wire or write us at the factory—see us in Section F, Building B at the International Aircraft Exposition, St. Louis, February 15 to 23, where our attractive sales franchise for 1930 will be explained. STEARMAN AIRCRAFT CO., WICHITA, KANSAS, Division of United Aircraft and Transport Company.

An ancient process, proper forging is still the accepted way to put maximum strength and endurance into parts of steel or iron.

Broad Technical Knowledge . . . Mastery of Design . . .

Laboratory-Controlled Production . . . Unequalled

Physical Equipment . . . Able Man-Power . . .

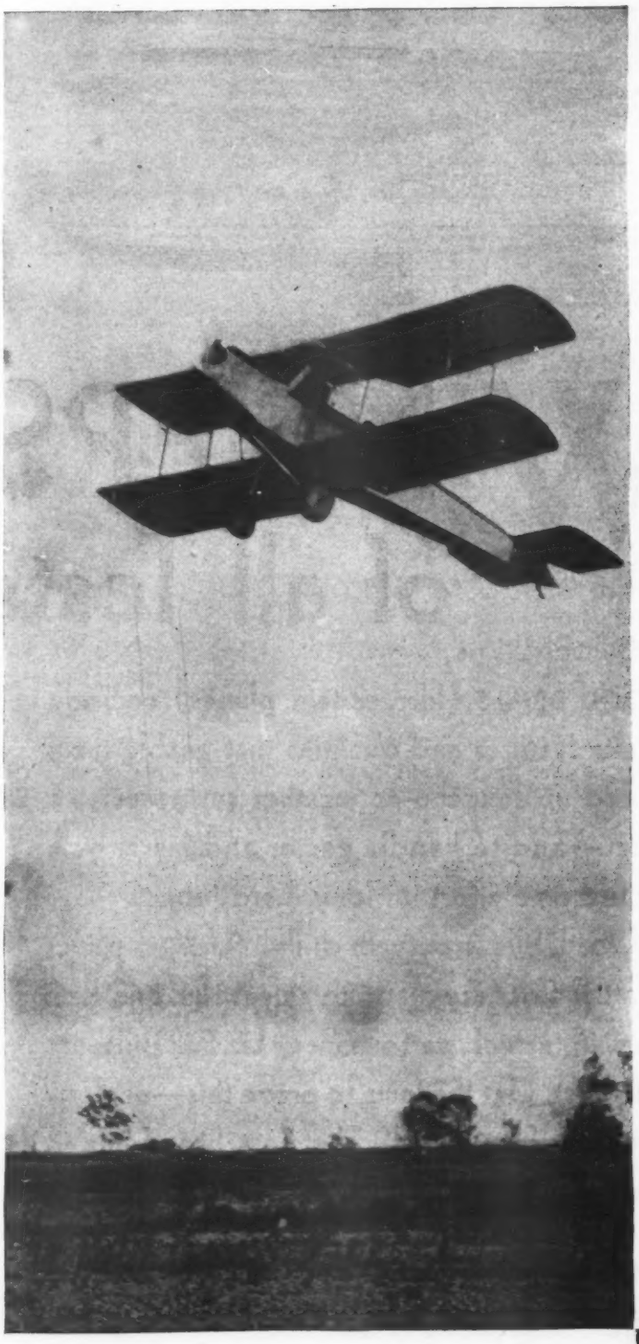
Champion laboratory-control methods eliminate the chance of faulty steel, failures in the forging process or incorrect heat treatment. Frequent chemical, microscopic and physical tests make Champion drop-forgings dependable and uniform—worthy of your confidence and your product.

THE CHAMPION MACHINE & FORGING COMPANY
8695 East 78th Street
CLEVELAND, O.

CHAMPION

DROP-FORGINGS

It takes off in 50 YARDS



. . . but that's only one *reason pilots in 16 countries call it the world's SAFEST light plane*

FIGURES show that take-off crashes account for 12% of all airplane accidents in this country.

That's why Avian engineers gave the Avian perfect take-off performance.

The designers cut its weight to only 875 pounds—including the 95 h.p., Cirrus air-cooled engine that holds more records than any other light plane motor in the sky lanes.

The Avian's cushiony, split-axle undercarriage insures smooth running over the bumpiest of ground. Its Handley-Page wing slots permit the pilot to pull its nose up sharply without danger of crashing from a stall.

Just take a hop in an Avian. Taxi to the runway—it handles like an automobile. Then give it the gun. What power! What precision of controls! You're ready to nose up before you can say "Jack Robinson"!

Throughout the flight, the Avian insures supreme safety. Its structure is 8 times strong enough for normal flight—a structure that enables it to stunt with the ease of a pursuit plane. Yet the Avian will not spin, for those automatic slots stabilize the ship with little loss of altitude and speed.

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AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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EDWARD P. WARNER. *Editor*

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Show Time Again

THE AERONAUTICAL WORLD is converging, as these lines appear, upon the St. Louis Arena. For the first time since last April we are coming together for an indoor show with no flying competitions attached. The period of ten months that has intervened has, we believe, been more fraught with consequence for the airplane industry, and has given us a better idea of its real ultimate status, than any other like interval since the War, not excepting the historic times of the Lindbergh flight.

We are in the last stage of the transition of aviation from a "game" into a genuine industry.

The builders of aircraft and their parts and accessories, and those who are interested in their operation, are coming to the Show in a spirit of determination to know the whole truth about themselves and their business, whether it be pleasant or otherwise. That fact is the most encouraging sign upon the horizon. Never before has there been greater sobriety of purpose. Never has there been a clearer realization that the interest of the whole industry is tied together. We shall be very much surprised if the meetings of the Aeronautical Chamber of Commerce, and especially its discussions with the personnel of the Aeronautics Branch of the Department of Commerce, are not better attended and productive of freer discussion than ever in the past.

We have learned a great amount about selling in the last year, but there is much yet to learn. The purpose of an aviation show is not to harvest a crop but to plant a seed. The advantages of selling a few individual airplanes by dint of making diligent whoopee in company with the prospective purchasers are negligible compared with the benefits that can be derived from showing the aviation industry in a favorable light to a large group of intelligent visitors and from starting dealers off on the right foot for the selling season. The dealer in airplanes ought to come to a national show with the object of garnering a collection of useful ideas. Both the airplane and the automobile industries and others as well, have unfortunately been copiously furbished in the past with dealers who saw in a show primarily an opportunity for getting behind on their sleep and accumulating a series of headaches.

There is always a tendency to judge the interest of an exhibition by the number of spectacular novelties that are on display. We are in a position to realize that there will be no dearth of novelties at St. Louis, but that is no measure of the importance of the affair. The Show would still deserve attention if the technical development for the year had been purely evolutionary and of the minutest character, or if all of the new models that are to be on display had been announced weeks ago. It is, in fact, the little things that make the show most important. Revolutionary modifications can be seen quite as well from drawings and photographs and written descriptions as by examination of the structure "in the flesh." To appreciate the cleaning up of design in minor detail, however, one must have the products of the whole industry conveniently available for direct comparison.

The Show is serious business and every possible benefit should be drawn from it as such, but it is impossible not to feel a little holiday spirit as one starts for so pleasant a gathering of all the aeronautical talents. As we pack our suitcases and leave a hurried instruction for handling mail in our absence, our minds (if we are venerable enough to permit) turn back a quarter of a century. Our steps unconsciously grow a little jaunty, and we swing away towards the airport or station to the lilting refrain of "I'll meet you in St. Louis, Louis, meet you at the fair."

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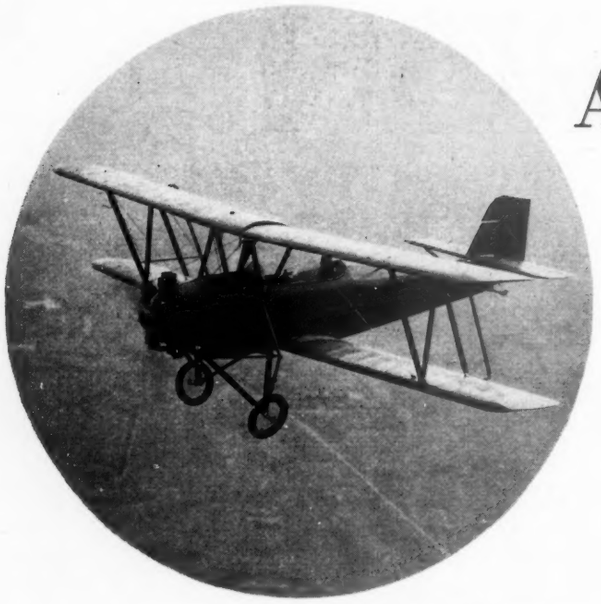


Flight picture of the Kinner powered training plane produced by the New Standard Aircraft Corp.

A FORECAST OF

Plans of the Exhibitors in

By
LESLIE E. NEVILLE
Technical Editor of AVIATION

WHAT IS EXPECTED to be the most extensive exposition of American aircraft products ever held will be officially opened this evening (February 15) in the New Arena in St. Louis. Two hundred exhibits comprising nearly 100 airplanes and a large number of engines and accessories constitute the 1930 International Aircraft Exposition sponsored by the Aeronautical Chamber of Commerce of America.

At the time of writing the program calls for a mass flight of 40 airplanes to fly over St. Louis, taking off at noon and, in order that demonstrations may be made and planes may land adjacent to the arena, runways on a flying field in Forest Park are being put into shape. A colorful extravaganza depicting the history of transportation in which more than 200 persons will participate is to be held each night during the show period from February 15 to 23.

One of the principal purposes of this exposition is to set in operation a national merchandising program for the aeronautical industry. National conferences on aeronautical education under the auspices of the Aeronautical Chamber of Commerce in cooperation with the Daniel Guggenheim Fund Committee of Elementary and Secondary Aeronautical Education will be held during three of the nine days' gathering. Numerous trade and engineering conferences will take place during the show.

Nearly a dozen new models of aircraft will be introduced at the show and, according to present indications, a larger proportion of airplanes with floats, sea planes, amphibians and gliders will be shown. It is expected that greater refinements in airplane interiors, more cut-away engines and parts, and more structural exhibits will be staged. A brier résumé of the plans for the various exhibits is presented below.

Airplanes

AMONG the airplanes to be exhibited for the first time is the American C-2, a single seat monoplane of unique design intended for the flying student who wishes to accumulate sufficient time to obtain a transport license. Its power plant is a two-cylinder opposed engine rated 30 hp. at 2,500 r.p.m. This exhibit is sponsored by the Aeronautical Corporation of America.

Although previously shown at various local exhibits the Savoia Marchetti S-56, three place amphibian biplane, is being shown for the first time at a class A exhibit. This airplane, which is powered by the Kinner K-5 engine, is being produced by the American Aeronautical Corporation which also has manufacturing rights in America for other Savoia Marchetti designs.

Five airplanes will be shown by the American Eagle Aircraft Corporation and the feature of the exhibit will be the new four place American Eagle monoplane pow-

The J-6 powered Fairchild "42" Custom Foursome

THE *St. Louis Show*

Brief, List of Exhibitors and Program of Events

Front quarter view of the new Curtiss "Kingbird" powered with two J-6-8 Wright engines

ered with the Wright J-6-5 or J-6-7 engine. This airplane was designed by Stanley Wallace, chief engineer for Wallace Aircraft Company, Inc., a division of American Eagle, and is of the folding wing type intended to store in a space 13 x 25 ft. Two forward and one rear door are provided for entrance to the cabin and a large portion of the center section is made transparent

A rear view of the Lycoming engine

through the use of non-shatterable glass. A considerable amount of this material is used in the cabin structure to obtain desired visibility.

Two "Pacemaker" monoplanes, one equipped with landing gear and the other with floats, will be displayed by the Bellanca Aircraft Corporation. These 1930 models are powered with the Wright J-6-9 engine and are available not only as six place planes but also as combination four-passenger and freight carriers. This transformation is made possible through the elimination of the two central passenger seats of the cabin and the substitution of a 34 cu.ft. metal freight compartment and in this form the design is known as the Pacemaker Freighter. An interesting feature is that the weight empty of the craft is 2,290 lb. and the useful load 2,310 lb.

The J-6-9 powered Standard Airsedan manufactured by the Buhl Aircraft Company, Marysville, Mich., will be shown by that company at the exposition and the record breaking plane of this type known as the "Spokane Sungod" is to be on the field for demonstration purposes.

REALIZING the increasing popularity of gliding as a sport, the Cessna Aircraft Corporation is planning to exhibit a craft of this type in addition to its regular airplane models DC-6-B and DC-6-A. Another feature of this exhibit will be a section of the familiar Cessna wing.

Suspended from the ceiling of the arena by a steel cable will be a Challenger powered Command-Aire biplane with Edo floats. This plane will be illuminated by a Crouse-Hinds spotlight. An unusually attractive black and white color scheme is planned for the suspended plane. On the floor of Building B will be another Command-Aire plane powered with the Lycoming engine and embodying some construction features that are new to Command-Aire design. In this airplane the undercarriage has been changed and the tail group has been somewhat modified. A third Command-Aire plane powered with the Warner Scarab engine will be located either at the show or at the airport.

A very comprehensive and complete exhibit of aircraft has been announced by the Curtiss-Wright Corporation and will include some sixteen airplanes ranging from the three place open biplane type to the Condor eighteen-passenger transport. Among the other planes in the exhibit will be the Curtiss Tanager, winner of the Guggenheim safe aircraft competition; the Travel Air

low wing monoplane which performed so creditably during the National Air Races at Cleveland, the Curtiss Robin, the Keystone-Loening Commuter and the Keystone Patrician. The most recent addition to the Curtiss line is the "Kingbird," a twin engine cabin monoplane powered by two J-6-7 engines and embodying several new features in aircraft construction. It is also possible that the Carrier Pigeon II, an unequal span staggered biplane intended for mail carrying, will be shown. This craft is powered with a twelve cylinder Geared Conqueror engine and is characterized by a fuselage of the semi-monocoque type constructed in three sections built separately and bolted together.

The D-1 monoplane manufactured by the Davis Aircraft Corporation is to be shown and is worthy of mention because of the unusual aerodynamic features of the wing. It will be remembered that the wing section of this plane is a Gottingen 387 at the lift strut attachment points and tapers into a Clark Y at the center section and a modification of the Clark Y section at the tips.

A HIGHLY IMPRESSIVE EXHIBIT is being planned by the Detroit Aircraft Corporation. One of the features of which will be the unveiling of the Ryan Foursome on the opening night of the show. The Foursome is the 1930 model of the Ryan division of the corporation and is a four place plane built along the general lines of the previous models, having an unusual interior arrangement. Back of the front seat is designed to fold down joining the seat behind, forming a comfortable lounge, while the other seats are all adjustable to reclining positions. The wing of the Foursome is made in two panels for greater ease in handling while a number of improvements have been made in the control system. It is powered with a Wright J-6-7 engine. The Ryan division exhibit will also include the new Ryan Wasp, a six place cabin monoplane.

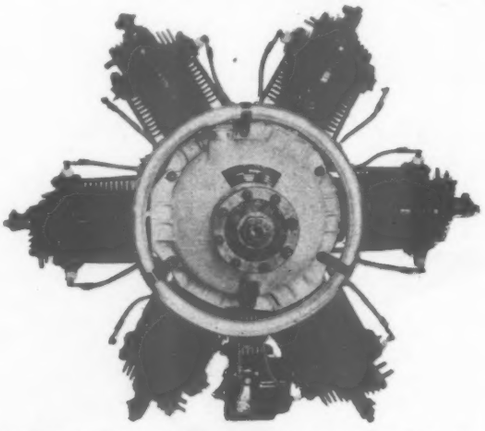
Other features of the Detroit Aircraft exhibit will be the display of the Lockheed Sirius, low wing open monoplane and duplicate of the plane recently delivered to Col. Lindbergh, and the standard Lockheed Vega. The Eastman division of the corporation will show the latest Challenger powered Eastman flying boat and two of the airplanes manufactured by the Parks division also will be displayed. A training glider will be included and a wind tunnel model of the proposed MC-25, a new metal clad dirigible capable of carrying 100 tons also is to be on display.

FOLLOWING a long period of development the Driggs Skylark, most recent creation of Ivan H. Driggs, chief engineer of the Driggs Aircraft Corporation, is ready for introduction and will be shown at St. Louis. The Skylark, which is powered with the Rover four cylinder inverted-in-line engine, is a highly staggered biplane with tandem seating arrangement. Wings are fabric covered over stamped aluminum alloy ribs and spruce spars and the fuselage is the conventional steel tube type with cockpits reinforced with circular hoops of large diameter steel tubing for safety to personnel and to eliminate weave through the portion of the fuselage where normal bracing cannot be placed.

THE EXHIBIT of Fairchild Airplane Manufacturing Corporation will be featured by the model 42 Custom Foursome, a high wing cabin monoplane powered with the Wright J-6-9 engine. This plane embodies the Fairchild folding wing and has interchangeable wheel or flotation gear. In addition to this plane the Fairchild 71, KR-34 and KR-21 also will be shown.

The current model of Kinner powered Fleet airplane will be exhibited together with flotation gear for use in connection with this craft.

Models of the Standard Universal, Super Universal and F-10-A trimotor Fokker airplanes will be shown



The Brownback Tiger which is now being produced by the Light Manufacturing & Foundry Company

with no radical changes from accepted practice in the exhibit of the Fokker Aircraft Corporation, Division of General Motors Corporation.

Two aristocrats, one powered with the Warner engine and the other with the J-6-5 Wright power plant, will be exhibited by the General Airplanes Corporation, the reorganization of that company having made it impossible to prepare the model 107 Mailplane for display at the show.

THE Great Lakes Aircraft Corporation is departing from its practice of the past by exhibiting only one airplane instead of several. This craft, a Trainer model 2T-1A, is to be especially a show plane and in addition to blue and gold finish and chromium plated trimmings, will have a special instrument board built by Pioneer and so designed that all dials are placed in such a manner that their pointers indicate toward the center of the board under normal conditions. The front cockpit of the plane will be covered over to form a baggage compartment.

Two aircraft, one an amphibion and the other a flying boat, will be shown by Ireland Aircraft, Inc. One of these, the N-2-C five place cabin amphibion has been in production for some time, while the other, the M-1, two place open flying boat, is a very recent development. The larger airplane has an all metal structure with fabric covering and is powered by the Pratt-Whitney Wasp engine. The smaller is powered with the LeBlond 60 and is available with amphibion landing gear with the LeBlond 90, Gypsy, Cirrus and other engines of the same horsepower range. The hull has a wood structure and alclad skin. The M-1 is an externally braced monoplane, while the N-2-C is a biplane. Wing ribs, tail ribs, and many other parts are interchangeable on both crafts. It is interesting to note that both planes are pushers.

Three airplanes, all two-place open cockpit biplanes and powered with the OX-5, Kinner or Warner engines. will be exhibited by the Lincoln Aircraft Company, Inc. These airplanes are all of conventional construction.

The new Mohawk Pinto with a number of refinements over the previous model will be shown. Among the

improvements are dual instruments in front and rear cockpits, individual doors for passengers and pilot, and large inspection windows under the wings and fuselage.

A new addition of two-place cabin monoplane will be exhibited by the Mono Aircraft Corporation. This plane, which is to be the outstanding model of the Mono Aircraft line for 1930, is powered with the Lambert R-266 engine, successor to the Lambert Velie M-5 engine.

THE NEW Standard Aircraft Corporation will display the model D-25 at the show and the model D-29-A Trainer will be either at the show or at the airport. These airplanes are noteworthy because of the somewhat unusual use of open section duralumin in the fuselages. The Trainer is the latest model to be brought out by this company and several have been ordered by the Navy.

The Barling NB-3 low wing monoplane, manufactured by the Nicholas-Beazley Airplane Company, will be shown. Three of these completed airplanes as well as a number of structural parts will be included in the exhibit. The new PA-7 Mailwing, a refinement of the Pitcairn PA-6 plane, will be shown by Pitcairn Aircraft, Inc. Improvements include rounded wing tips, special retractable landing lights, a new method of cowling the engine, and a new arrangement of instruments. Announcement has been made by the Spartan Aircraft Company of its plan to exhibit the new Spartan D-3-225 biplane powered with the J-6-7 Wright engine. This is the second Wright powered Spartan airplane.

Three Cardinals powered by the Kinner engine will be exhibited by the St. Louis Aircraft Corp. The Cardinal is a two-place externally braced cabin monoplane of conventional construction.

Two new Stearman models will make their debut at the exposition and will be shown together with other exhibits of the United Aircraft & Transport Corporation. The Business Speedster follows closely the familiar C-3-B and is characterized by improved streamlining and additional instrument equipment. The most recent model of this company is the Stearman Junior Speed Mail available with either the Pratt & Whitney Wasp Senior, Wasp Junior or Wright J-6-9. A number of other improvements are included.

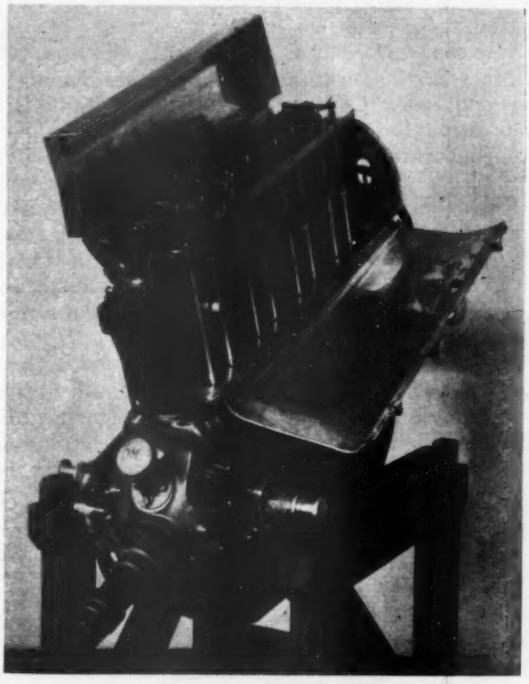
Six models constituting the 1930 line of the Stinson Aircraft Corporation will be displayed by that company. All of these are closed monoplanes. The group is to include three models of the Stinson Detroiter Junior, one powered with a 210 hp. Lycoming engine and the others with the J-6-7 and J-6-9 Wright engines. Two models of the Stinson Detroiter Senior will be shown, one powered with the J-6-9 engine and the other with the Pratt & Whitney Wasp Senior. A feature of the exhibit is to be a tri-engine plane recently developed by the company. In connection with the Stinson Junior it is interesting to note that Aerotruss channel section steel ribs are being used in the wing structure which is a departure from previous practice.

A THREE-ENGINE de luxe club plane will be shown by the Stout Metal Airplane Company, division of the Ford Motor Company, and will be fitted with complete night flying equipment, electric starter and motor generator. The power plant is three Pratt & Whitney Wasp engines. The exterior finish, called "Birds Eye," produces the effect commonly found on the inside of watch cases. The interior may be fitted with six special reclining chairs, four of which are so grouped that a card table may be attached to their arms. A folding berth is located in the high ceiling portion of the cabin and arranged so that it may be folded up into the ceiling when not in use. Directly below this berth is a small davenport. In the after portion of the cabin is a complete kitchenette equipped with hot plates, thermos jugs, kitchen utensils, sink and drainboard.

The latest model Air Coach will be exhibited by the Verville Aircraft Corporation. This plane is powered with a Wright J-6 engine and has several novel features.

The usual display of current models of the "225" Straight Wing and "225" Taper Wing biplanes are to be exhibited by the Waco Aircraft Company and a number of minor improvements have been made in the current models with no radical changes, in accord with usual Waco policy. It is planned if possible to introduce the new Waco 110 which is the latest model and has been developed along the general lines of its predecessors.

The exhibit of the Whittelsey Manufacturing Company will constitute the new Whittelsey Avian which differs from the British production model in that it is constructed with a welded steel tube fuselage and has certain other minor modifications in the structure. This plane will be featured with Handley Page automatic slots having ball bearing and torque tube control mechanism.



Cowling designed by the Wright Aeronautical Corporation for the Gypsy engine

Engines

THE EXHIBIT of the Axelson Aircraft Engine Corporation will be similar to its display in past shows and it is planned to adhere to a three-color scheme of modernistic application throughout. It is commendable that the company is planning to exhibit more working parts than have heretofore been shown, while a group of intimate manufacturing photographs also will be displayed.

The Brownback Tiger C-400, which is now being produced by the Light Manufacturing and Foundry Company, is to be included in the engine exhibits. The Brown-

back engine is a six cylinder staggered radial type developed by the Brownback Motor Laboratories.

While no new features are noticeable in the engine to be exhibited by the Comet Engine Corporation, an original method of presentation has been developed by the company. This is known as the Comet "portmanteau booth" and its main feature is that it is easily disassembled and crated and can be so built as to fit into a number of different sized and shaped spaces. This booth with appropriate trimmings and draperies will be used to display the Comet engine at St. Louis. Following to some extent the practice commonly employed at automobile shows, the Continental Motors Corporation will display a cutaway model showing the moving parts of the A-70 engine in section. In addition there will be an assembled engine and an exhibit of the separate parts.

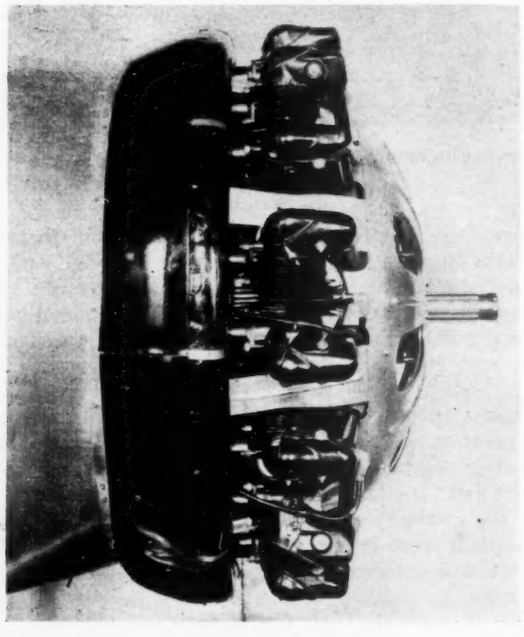
THE NEW six cylinder in-line inverted air-cooled 6-370 engine recently completed by the Fairchild Engine Corporation will be one of the features of the Fairchild exhibit. This engine recently completed a 50 hr. non-stop test run at 9/10 full load and at full throttle alternately and the company plans to produce it in the near future.

Spaces 227-230 will be occupied by the Kinner Airplane and Motor Corporation and the exposition will be the occasion for the announcement of the new Kinner five cylinder radial engine model R-715 which is now being placed in production. Units, parts and assemblies of Kinner engines will be displayed along with several K-5 models and a special cutaway of this engine.

It is planned by the Lambert Aircraft Engine Corporation to display the new model R-266 five cylinder radial air-cooled type, the most recent creation of that company.

A number of changes resulting in increased horsepower output have been made in the Lycoming Aero Engine and these will all be clearly shown at the exhibit in St. Louis.

An interesting parts display is planned by the Michigan Aero Engine Corporation for the Rover four cylinder-in-line inverted power platn. The new Rover model R-267 is somewhat similar to its predecessor but has a number of refinements and an appreciably higher rated output.



Wasp engine cowling recently developed by Pratt & Whitney

THE WASP JUNIOR, together with the Senior model, will be shown in a position to indicate their comparison in the exhibit of the Pratt & Whitney Aircraft Company. This together with the Series B Hornet and other engines of the company's line will feature the exhibit. A special Pratt & Whitney designed manifold cowling will be shown for the first time. This cowling and collector combination consists of a nose cowling with adjustable shutters, a collector ring on the rear of the engine and a fairing which serves as a preheater combination on the rear of the engine. Suitable connections and controls are provided.

Two new L head radial engines, an improved development of previous models, are to be exhibited by the Szekely Aircraft and Engine Company. These engines are successors to the previous three and five cylinder engines manufactured by the company. The 1930 model of radial engine manufactured by the Warner Aircraft Corporation also will be shown.

THE Wright Aeronautical Corporation will feature its regular line of engines in Building A. It is planned to show a sectional J-6-9 engine together with the completed models and the feature of the exhibit will be an improved cowling for the Gypsy engine. This cowling, which is furnished as standard equipment with the engine, is designed for simplicity and accessibility as well as effective streamlining and cooling. Spool shaped projections are provided for mounting the engine and will be shown clearly in the exhibit.

Accessories

THE Aero Supply Manufacturing Company, Inc., together with its subsidiaries, Standard Automatic Products Company and National Steel Products Company, will exhibit its full line of aircraft hardware and detailed utilities. More than three thousand items are included in this line. A feature of the exhibit will be the Barlow fuel pump which has been designed to supersede the C-5. The representation of the Air Maze Corporation will be the installation of the air filter manufactured by that company on a number of planes at the show.

Recent developments in aircraft and weather instruments will be featured by the Consolidated Instrument Company of America, Inc. This exhibit will include special custom built instrument panels for a number of standard airplanes, as well as modern airport equipment for weather stations. Standard types of instruments will be shown in actual operation.

The new type SH 4 hand turning gear type of starter brought out for the Kinner K-5 engine is to feature the exhibit of Eclipse Aviation Corporation, division of Bendix Aviation Corporation. Other starters ranging from 8½ lb. weight upward also will be shown. Aircraft radio developments including a double voltage, voltage regulated engine driven generator and a dynamotor will be included.

In addition to the large number of airplanes to be exhibited with standardized Edo floats, the company will maintain a separate exhibit showing the eleven standardized models. The display will feature a model J-5300, one of the larger standardized lines and a complete model 1525 float installation which will include two of the smaller standardized floats together with all the necessary struts and attaching fittings.

A display board showing drop forgings for rocker arms, axles, exhaust flanges, engine gears, manifold clamps, and a number of fuselage parts, will be shown by the Endicott Forging and Manufacturing Company, Inc. Although no plans have been made by the Fafnir Bearing Company exhibit, this firm will have their newly developed standardized ball bearing and several of the planes, notably Pitcairn and Stearman and the pulley bearings and the pulleys being exhibited by the Westinghouse Electric and Manufacturing Company along with its other products.

THE CENTRAL FEATURE of the exhibit of the Fairchild Aerial Camera Corporation, the new Fairchild F-4, an all purpose product intended for a wide variety of work in commercial aerial photography. In addition to this, the exhibit will include several military types of cameras, one of these the model K-8, being fully automatic, operated with a wind engine driven generator. The model T-4, which takes one vertical exposure and three oblique photographs at the same time, also will be shown. This camera is also supplied with a rectifying printer which changes the oblique to vertical.

A display board upon which will be mounted instrument panel equipment for engine temperature indicators, magneto compasses and other aircraft devices will be shown by the General Electric Company. Working exhibits of complete magneto compasses, oil immersion heaters and gasoline gauges will be shown as well as a wing landing light designed to be built into the leading edges of airplane wings. In the aircraft lighting field will be shown a glass dome beacon, a rotating beacon, obstruction and boundary lights, approach lights and type ALF airport floodlight; an electric code beacon, a ceiling light and oncourse lights, supplemented by a type L-31 hangar floodlight which completes the display.

Various sizes of air struts for airplanes will be displayed by the Gruss Air Spring Company. A motion picture showing the complete action of the Gruss Air Strut on an airplane will be a feature of the exhibit.

Spaces 97 and 98 have been reserved by the Hamilton Standard Propeller Corporation, a division of the United Aircraft and Transport Corporation. The display of this company includes propellers for the smallest and largest aviation engines now in general use. In the low horsepower range, the company will exhibit the new light weight models weighing from 27 to 37 lb. and for the large geared engines of 500 to 600 hp., a sample blade from a propeller 13 ft. in diameter will be shown. Samples of service equipment will be on display and a number of cutaway models will be included.

N.A.C.A. cowlings, wing tips, wheel fairings, propeller noses and other special metal parts will constitute the exhibit of the Hill Aircraft Streamliners Company, an outgrowth of the Hill Auto Body Company which made its debut into the aeronautical field just recently.

AN INTERESTING innovation in the parachute field is the new Quick-Connector type which is to be introduced by the Irving Air Chute Company, Inc. This new development is intended primarily for closed airplanes and makes it unnecessary for the wearer to wear the parachute except when necessary. The harness is worn at all times by the passenger and the pack placed on a convenient hook within arms reach. The harness is essentially the same as the standard type except that, suspended from the shoulders of the wearer and in front to a line slightly above the waist, are two safety hooks or snaps. There are two small metal bars on the top of the pack and they can be quickly attached to these safety snaps with two quick natural movements of the arm, it only being necessary to pull the pack back against the breast of the wearer, so that the two metal bars click into the snaps. In other respects the parachute is of the same type and quality as that made by the Irving Company.

Interior of the Ryan Foursome showing the convertible seat-couch design

The new Luxor No. 8 goggles designed in an attempt to overcome air seepage and too tight adjustment will be shown by E. B. Meyrowitz, Inc. Other features of these goggles will be reduction in weight of frames which are of aluminum alloy, a new patented clutch type micro-adjustable bridge and an improved ventilating system.

An especially designed set of panels and an elaborate layout of parts and supplies for airplanes and engines will be shown by the Nicholas-Beazley Airplane Company, Inc. Instruments, lights, tires, propellers and engine parts representing a total of six to eight thousand articles are to be exhibited, according to the company announcement.

SEVERAL new instruments will be shown by the Pioneer Instrument Company and will include electric tachometers, pitch indicators, an altimeter in which both pointer and dial can be made to rotate at the same time if necessary, and some of the most recently developed navigation equipment. The electric tachometer consists of two units, a generator and an indicator, the former being driven by the engine and mounted directly on the tachometer drive and connected by two electric conductors to the indicator on the instrument board. The pitch indicator consists essentially of a pendulum connected to a gyroscope which is kept in rapid rotation by an air jet.

An entirely new model of aircraft radio beacon receiver representing a distinct improvement over its predecessor will be introduced by the Radiomarine Corporation of America. This display will also include a communication receiver for use in aircraft together with two new models of aircraft transmitters, all of which are designed for both local and remote control and operation from either a dynamotor, engine driven or wind driven generator. Of interest to airport operators will be the airport weather receiver especially intended for reception of Department of Commerce voice broadcast of air, weather and landing field conditions. Transmitting equip-

ment for aircraft will be supplemented by companion units which are ground transmitters for use at the airports as well as special high frequency receivers for use at ground stations for reception of communications from planes.

Latest models of parachutes will be exhibited by the Russell Company and a number of demonstrations will in all probability be held at the airport.

Most recent developments in radio shielded ignition switches and magnetos will be shown by the Scintilla Magneto Company, division of the Bendix Aviation Corporation. Other features of the exhibit will be magnetos showing the two bolt and three bolt mounting flange recently standardized by the S.A.E. and the vertical double type magneto with distributors and magneto replacement units for Curtiss OX-5, OXX-6 and Hispano Suiza engines. The new lever type breaker will be shown and a coil exhibit showing finished products, materials used in manufacture and other interesting units will be on display.

Refinements in design of the Heywood injection starter will be shown in the exhibit of Sky Specialties Corporation and the most recent model of this accessory has been produced with an overall weight of under 30 lb. for use with the lighter type engines. Another feature of the exhibit is the "Hi-Duty Sky Service Connection," a copper tubing connector made especially for aeronautical use to withstand the vibration conditions in this type of service. Booths 17, 18 and 19 in Building B will be devoted to the exhibit of summer flying suits, helmets, goggles and other aeronautical wearing apparel manufactured by A. G. Spalding & Bros. A sample board carrying the full range of sizes of both streamline and internal square section tie rods is to be shown by the Stewart Hartshorn Company.

WHILE it is not definitely determined at the time of of writing, it is hoped that it will be possible for the Stromberg Motor Devices Company to exhibit the new downdraft aircraft carburetor and the new horizontal type in addition to the regular single, double and triple barrel carburetors. It is almost certain that one of the two newer models will be shown. In addition to these products a set of tools and tool kits recently designed by the company for use in serviceing carburetors will be of interest to pilots and maintenance men in the industry. A complete display of its products will be shown by the Supreme Propeller Company.

In anticipation of the adaptation of ethelyne glycol as a cooling medium, the Taylor Instrument Companies will exhibit a special thermometer for that particular purpose. This thermometer has a range of 100 to 360 deg. F., or 40 to 180 deg. C., and is made in the same dimensions as the Tycos pressure gauges which also are to be shown. Another interesting addition to its line is the triple gauge which consists of three separate gauges in one standard case. It is composed of two pressure gauges, one for fuel and the other for oil, and an engine thermometer. When the engine operates under normal cruising conditions the three hands are at an angle of 90 deg. with each other so that any departure from usual conditions is indicated at a glance. This triple gauge weighs less than three separate instruments. The company will also show its sensitive type altimeter in its improved form, that is with the addition of the barometric dial; the Tycos cabin altimeter; a distance reading indicating thermometer of vapor tension type in two ranges; and a complete display of altimeters in the various ranges. A water and moisture proof case made entirely of nonferrous metal is employed in a number of these instruments.

A COMPREHENSIVE EXHIBIT based on the recently developed plane to ground radio telephone communication is planned by the Western Electric Company. This will include the plane transmitter and receiver, ground transmitter and receiver together with power apparatus to operate the various units. Interesting features are to be the crystal frequency control and 100 per cent modulation. The recently developed microphone for plane use and the special pilot's head set which leaves hands free for operation of the plane and makes it possible to send and receive while flying, also will be shown.

Materials

INCLUDED in the Material section of exhibits will be an effective decorative setting for the various aircraft products of the Aluminum Company of America. These include sand cast forgings, die cast and permanent mold cast parts in aluminum; sand cast magnesium parts; and formed and fabricated sections of aluminum sheet tubing, bar and other stock.

The familiar "Bird Series" of oil paintings showing airplanes painted to resemble birds in panels for different color combinations for aircraft is to be shown by Berry Bros. Spaces 61 and 62 in Building B have been reserved by the Bethlehem Steel Company to display alloy steel bars, airplane engine forgings and illuminated pictures in colors showing the manufacturing processes in the production of alloy steels.

Ignition shielding for radio as developed by the Breeze Corporations will be shown in Booth No. 184. This type of shielding takes care of the entire ignition system, including the spark plugs and ignition wires from the magneto to booster and switch. New models of commercial oleo-pneumatic and oleo-spring shock absorbers together with exhibits of special forgings from which its struts are made, will be included with a large number of different sizes of Aerol shock absorbing struts in the exhibit of the Cleveland Pneumatic Aerol Company in spaces No. 49, 50 and 51.

Duralumin-Plymetl, Haskelite, Balsa-Haskelite and Balsa-Plymetl will be shown by the Haskelite Manufacturing Corporation. These products will be exhibited in such a way as to show their various applications in aircraft construction and the familiar scene-in-action sign previously used by this company will be in the center of the exhibit.

In Booth No. 203, Building A, there will be several display boards showing the streamline round and square drawn tie rods as well as the safe lock terminals developed by the Macwhyte Company. Two large picture panels will be in evidence, each having approximately fifteen photographs of airplanes using these products.

In an attempt to show the advantages of heat treating of metal parts used in aircraft construction an instructive display has been prepared by Metlab. One of the features is a rack holding four equal lengths of tubing having equal strength per section and demonstrating a weight saving range from 1.41 lb. per ft. to .33 lb. per ft. A number of completely fabricated and heat treated parts as furnished by Metlab will be shown including wing beams, axles, landing gear struts and others.

Lighting and ignition cable are features of the showing of the Packard Electric Company and a radio shielding assembly utilizing improved type ignition cable recently

developed by the company will be shown in Booth 77. In this cable the shielding braid is protected from all damage and the complete assembly weighs approximately 4 lb.

THE NEW cut-to-specification method of furnishing spruce for airplane manufacturers will be featured in the exhibit of the Posey Manufacturing Company, either at the show or at one of the official hotels. This method which is being used increasingly by manufacturers has been developed to eliminate the uncertainty and waste in the purchase of spruce for airplane construction. Spars and ribs are now available in this form.

The new Irving "quick connector" parachute

A board containing samples of aircraft cord, strand, wire and also insulated wires and cables, will be shown by John A. Roebling's Sons Company. Booths Nos. 143 and 144 have been assigned to the Summerill Tubing Company, which exhibit will be held in conjunction with that of Metlab. Assembled fuselages showing seamless tubing in the raw state; sections of tubing in round, square, streamline and elliptical form; fabricated parts and other assembled parts will be shown.

The exhibit of the Timken Roller Bearing Company will occupy Booth No. 74, Building B, and will consist of a number of Timken equipped tail and landing gears as used by various manufacturers, a display of bearings designed especially for airplane service and an action display of a Timken equipped rocker arm for an airplane engine. Tubular and clinch rivets in various materials will be shown by the Tubular Rivet & Stud Company. Representative forgings for various types and sizes of aircraft engines including such parts as crankshafts, connecting rods, propeller hubs, cam rings and miscellaneous gears will be displayed by the Wyman Gordon Company.

Production Equipment

IN THE Production Equipment division will be an exhibit by the Black & Decker Manufacturing Company showing its latest aeronautical products and a number of company executives will fly to St. Louis in the official Travel Air monoplane used by that company.

Gears for airplane engines and accessories will be shown in the exhibit of the Indianapolis Tool & Manufacturing Company, which will include one of the cam shafts and pinion for the Kinner K-5, accessory drive shaft for the Wright Gypsy, impeller gear for the Wright Whirlwind engines and a group of gears used in magneto drives for Kinner, Fairchild and General Air Motor companies.

A model monoplane fuselage 6 ft. long and built to scale with small diameter tubing will be shown by the Linde Air Products Company and associated companies. Specimens of oxwelded tubing will be tested on an Oxweld portable tensile strength testing machine. The standard products of the company, including the oxwelded type W-15 welding blow pipe and others, will be shown.

Oil Company Exhibits

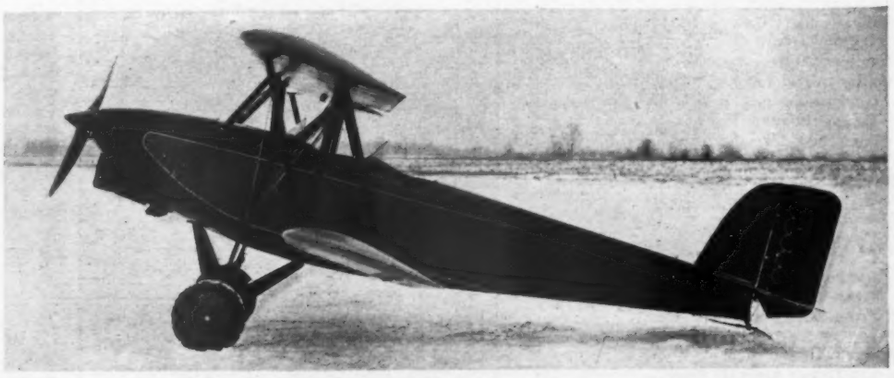
INTERESTING EXHIBITS are being planned by the various fuel and oil companies for their products. The Kendall Refining Company will display oils and grease as well as a record of its aeronautical accomplishments during the past year, while an extremely simple exhibit is planned by Quaker State. This will consist essentially of a 55 gal. drum with the distinctive green and white color combination placed upon a table with appropriate draperies and a small display board showing the refining process and samples of various byproducts.

The Standard Oil Company of Indiana will exhibit under the name of Stanavo Specifications Board Inc., an organization composed of engineers from the Standard Oil Companies of California, Indiana and New Jersey. The product exhibited is to be Stanavo aviation engine oil, a recent airplane lubricant development, and will be distinguished by two lighted revolving beacons and a large bronze sculptured model of the Stanavo trade mark. Plans are being made by the Texas Company for the use of a mechanical exhibit of the "Spokane Sungod." The Vacuum Oil Company display will consist of a new line of aircraft lubricants which has recently been introduced by this organization.

Airport Equipment

AIRPORT EQUIPMENT will be exhibited by the usual firms engaged in its manufacture and several new developments are to be introduced. Booth No. 85, Building B, has been allotted to the B.B.T. Corporation of American and will be used to display the large B.B.T. type M-8-D air mail landing floodlight complete with 150 ampere high intensity arc mechanism; and the type H-8-E intermediate landing floodlight; a flashing beacon and other standard products. Formal introduction of a new airport floodlight having a fresnel lens and utilizing a 3 K.W., 32 volt lamp as a light source will be made. This has been developed to meet the demand for an economical and efficient floodlighting unit to complete the line of B.B.T. products.

Representative products of the Crouse-Hinds Company will be shown and will include the type APB disconnect-

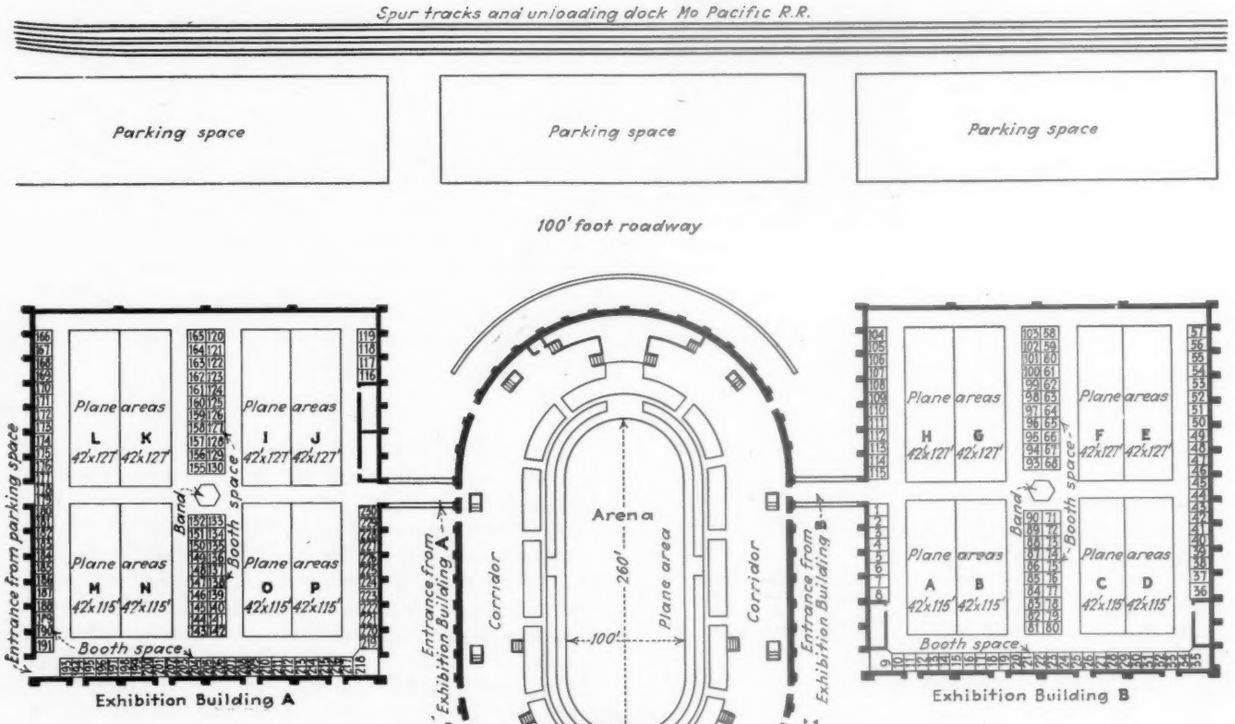


A side view of the Rover powered Sky Lark to be exhibited by Driggs Aircraft Corporation

ing boundary light, the ceiling projector and ceiling height indicator, a flush marker light, a 180 deg. landing field floodlight in two sizes and a number of others. Booths 146 and 147, Building A, will be occupied by the H. H. Robertson Company and will house samples of Robertson Protected Metal, a roofing and siding sheet made rust and corrosion resistant by successive layers of asphalt, asbestos felt and water proofing. Two models of hangars and sky lights, sash and ventilators also will be in the booth. A space at the show decorated in modernistic fashion will be used to display photographs of the airport work being done by the B. Russell Shaw Company Inc.

No airplanes will be displayed by the Boeing Company but an elaborate model air line showing a landing field in miniature and a map of its airway system is planned to be included in the exhibit of the United Aircraft & Transport.

Layout OF SHOW SPACE AND *List* OF *Exhibitors*



List of Exhibitors

PLANES

American Eagle Aircraft Co.
Bellanca Aircraft Corp.
Buhl Aircraft Co.
Cessna Aircraft Co.
Command-Aire, Inc.
Curtiss-Wright Sales Corp.
  Curtiss Aeroplane & Motor Co.
  Moth Aircraft Co.
  Keystone Aircraft Corp.
  Travel Air Co.
Davis Aircraft Corp.
Dare Airplane Co.
Detroit Aircraft Corp.
  Eastman Aircraft Corp.
  Lockheed Aircraft Corp.
  Parks Air College, Inc.
  Ryan Aircraft Corp.
Fairchild Airplane Mfg. Co.
Fleet Aircraft Inc.
Fokker Aircraft Corp.
Great Lakes Aircraft Corp.
Heath Airplane Co.
Inland Aviation Co.
Johnson Airplane and Supply Co.
Lincoln Aircraft Co., Inc.
Mono Aircraft Corp.
Mohawk Aircraft Corp.
Pitcairn Aircraft, Inc.
Spartan Aircraft Corp.
Stinson Aircraft Corp.
Stout Metal Airplane Co.
Szekeley Aircraft & Engine Co.
United Aircraft & Transport Corp.
  Boeing Airplane Co.
  Hamilton Metalplane Co.
  Stearman Aircraft Co.
  Sikorsky Aviation Corp.
The Verville Aircraft Co.
Waco Aircraft Co.
Whittesley Mfg. Co.
American Aeronautical Corp.
Driggs Aircraft Corp.
Ireland Aircraft, Inc.
New Standard Aircraft Corp.
Nicholas-Beazley Airplane Co., Inc.
Aero Corporation of America
General Airplanes Corp.

ENGINES

Axelson Aircraft and Engine Co.
Comet Engine Co. (Air Investors)
Continental Aircraft Engine Co.
Dayton Airplane Engine Co.
Kinner Airplane & Motor Corp.

Lambert Aircraft Engine Co.
LeBland Aircraft Engine Co.
Light Mfg. & Foundry Co.
Lycoming Mfg. Co.
Michigan Aero Engine Co.
Pratt & Whitney Aircraft Co.
Warner Aircraft Corp.
Wright Aeronautical Corp.

ACCESSORIES

Aero Supply Manufacturing Co.
Air-Maze Corporation
American Tel. & Tel.
Bendix Aviation Corporation
  Stromberg Motor Devices Co.
  Scintilla Magneto Corp.
  Eclipse Machine Co.
  Bendix Brake Co.
  Pioneer Instrument Corp.
Buhl Stamping Co.
Champion Spark Plug Co.
Consolidated Instrument Co.
Dayton Wire Wheel Co.
Edo Aircraft Corp.
Elgin National Watch Co.
Fairchild Aerial Camera Corp.
Gruss Air Spring Co. of Amer.
Hamilton Standard Propeller Corp.
Harwen Products
Hill Aircraft Streamliners Co.
International Flare-Signal Co.
Irving Air Chute Company
Joy Mfg. Co.
E. B. Meyrowitz, Inc.
Rand, McNally & Co.
Russell Parachute Company
Sky Specialties Corporation
A. G. Spalding & Bros.
Stabilaire, Inc.
Stewart Hartshorn Co.
Stuart Aero Products
Supreme Propeller Co.
Switlik Mfg. Co.
Taylor Instrument Co.
Western Electric Company
Westinghouse Electric Mfg. Co.

MATERIALS

Aluminum Company of America
Balsa Wood Company
Berry Brothers
Bethlehem Steel Co.
Bohn Aluminum & Brass Corp.
Breeze Corporations
Breeze Metal Hose & Mfg. Co.
Egyptian Lacquer Company
Endicott Forging & Mfg. Co.
Haskelite Mfg. Corp.
Imperial Brass Mfg. Co.
MacWhyte Co.
McQuay-Morris Mfg. Co.
Metallurgical Laboratories
Packard Electric Co.
John A. Roebling's Sons Co.
Summerill Tubing Co.
Timken Roller Bearing Co.
Tubular Rivet & Stud Co.
Universal Metal Products, Inc.
Wyman-Gordon Co.

FUELS AND OILS

Kendall Refining Co.
Quaker State Oil Co.
Richfield Oil Co.
Shell Petroleum Corp. of Del.
Sinclair Refining Co.
Skelly Oil Co.
Stanavo Specifications Board, Inc.
Texas Company
Vacuum Oil Co.

PRODUCTION EQUIPMENT

Air Reduction Sales
Black & Decker Mfg. Co.
Cleveland Pneumatic Tool Co.
Curtiss Pneumatic Machinery Co.
Hall & Brown Woodworking Machine Co.
Indianapolis Tool & Mfg. Co.
Linde Air Products Co.

AIRPORT EQUIPMENT

B.B.T. Corp. of America
Crouse-Hinds Co.
General Electric Co.
The Pyle-National Co.
Radiomarine Corporation
H. H. Robertson Co.
B. Russel Shaw Co., Inc.

General Schedule of Events

1930 INTERNATIONAL AIRCRAFT EXPOSITION

SATURDAY, FEB. 15

Doors open at noon.

8 p.m.—Formal opening.

SUNDAY, FEB. 16

No meetings.

MONDAY, FEB. 17

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, Commercial Airplane Manufacturing Section, Hotel Jefferson.

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, National Conference on Aeronautical Education, Statler Hotel.

10:30 a.m.—Sales Meeting.

TUESDAY, FEB. 18

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, National Conference on Aeronautical Education, Statler Hotel.

10 a.m. to 12 noon — Society of Automotive Engineers, Engine Session, Hotel Jefferson.

10 a.m.—Aircraft Industry Session, Arena.

10:30 a.m.—Sales Meeting.

2 p.m.—Aeronautical Chamber of Commerce, Motor Manufacturers Section, Hotel Jefferson.

8 p.m.—Society of Automotive Engineers, Fuel Session, Hotel Jefferson.

WEDNESDAY, FEB. 19

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, National Conference of Aeronautical Education, Statler Hotel.

10 a.m. — Society of Automotive Engineers, Instrument Session, Hotel Jefferson.

10 a.m.—Aircraft Industry Session, Arena.

10:30 a.m.—Sales Meeting.

2 p.m.—Aeronautical Chamber of Commerce, Air Transport Section, Hotel Jefferson.

6 p.m.—Aeronautical Chamber of Commerce, Joint Banquet with Society of Automotive Engineers, Hotel Jefferson.

THURSDAY, FEB. 20

10 a.m. — Society of Automotive Engineers, Radio Session, Hotel Jefferson.

10 a.m.—Aeronautical Chamber of Commerce, Flying School Committee, Hotel Jefferson.

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, Airport Committee, Hotel Jefferson.

10 a.m.—Aeronautical Chamber of Commerce, Distributor-Dealer Section, Hotel Jefferson.

10:30 a.m.—Sales Meeting.

2 p.m.—Aeronautical Chamber of Commerce, Joint Meeting Commercial Airplane and Motor Manufacturers, Hotel Jefferson.

2 p.m.—Aeronautical Chamber of Commerce, Accessory and Materials Section, Hotel Jefferson.

8 p.m.—Society of Automotive Engineers, Production Session, Hotel Jefferson.

FRIDAY, FEB. 21

10 a.m.—Aeronautical Chamber of Commerce, Fuel and Lubricants Section, Hotel Jefferson.

10 a.m. to 5 p.m. — Aeronautical Chamber of Commerce, Joint Meeting —Commercial Airplane Manufacturers and Bureau of Aeronautics, Department of Commerce, Hotel Jefferson.

10.30 a.m.—Sales Meeting.

2 p.m.—Aeronautical Chamber of Commerce, Finance-Insurance Section, Hotel Jefferson.

SUNDAY, FEB. 23

10 p.m.—Exposition Closes.

WHAT ARE THE *Prospects*

Leaders in the Industry Discuss the Problems of Production and Sa

THE YEAR 1930 is a difficult one for which to prophesy. The aircraft industry is in a period full of actual and potential change. Recognizing the awkwardness of forecast and the fallibility of individual prophecies, we have solicited the aircraft industry's leading executives to supplement our estimates of the future with their own. To secure an idea of the general average trend of the industry's most enlightened thought, we sent out some six weeks ago requests for contributions to a symposium upon the probable course of the industry in 1930 and upon the desirable courses of manufacturing and merchandising policy. The results are presented here.

CONTRIBUTORS TO THIS SYMPOSIUM

C. M. Keys, Pres., Curtiss-Wright Corp. ... 291
Graham B. Grosvenor, Pres., The Aviation Corp. ... 291
Frederick B. Rentschler, Pres., United Aircraft & Transport Co. ... 292
E. S. Evans, Pres., Detroit Aircraft Corp. ... 293
Temple N. Joyce, Vice-Pres., Berliner-Joyce Aircraft Corp. ... 293
Robert E. Lees, Sales Mgr., Waco Aircraft Co. ... 294
Sherman M. Fairchild, Pres., Fairchild Aviation Corp. ... 294
B. G. Leighton, in Charge of Sales, Wright Aeronautical Corp. ... 295
Wm. B. Robertson, Pres., Curtiss-Robertson Airplane Mfg. Co. ... 296
B. F. Castle, Pres., Great Lakes Aircraft Corp. ... 297
Paul Becker, Asst Sec'y, Chance Vought Corp. ... 298
Wm. B. Stout, Pres., Stout Metal Airplane Co. ... 298
Waldo D. Waterman, Gen. Mgr., Los Angeles Metropolitan Airport ... 299
C. V. Cessna, Pres., Cessna Aircraft Co. ... 299
E. E. Porterfield, Jr., Pres., American Eagle Aircraft Corp. ... 300
R. B. Snowden, Jr., Pres., Command-Aire, Inc. ... 300
Walter H. Beech, Pres., Curtiss-Wright Sales Corp. ... 301
W. B. Kinner, Pres., Kinner Airplane & Motor Co. ... 301
John H. Baker, Pres., Air Stocks, Inc. ... 302
J. D. Alexander, Pres,, Alexander Aircraft Co. ... 302
Glenn D. Angle, Vice-Pres., Le Blond Aircraft Engine Corp. ... 302
Edgar N. Gott, Pres., Keystone Aircraft Co. ... 303
C. S. "Casey" Jones, Pres., Curtiss-Wright Flying Service ... 304
H. N. Whittelsey, Pres., Whittelsey Mfg. Co. ... 304
A. O. Meurer, Ass't Sales Mgr., Aeronautical Sales Corp. ... 305
Minton M. Warren, Pres., Moth Aircraft Corp. ... 305

To secure specific comment upon what seemed to us the most important of the industry's problems, we included in our letter five specific questions to which the replies in some cases refer by number. They were:

1. The probable trend of the industry for the coming year. In other words, what shifts in financial industrial organization and in general relation between design, production, and sales appear probable? I should be particularly interested in any comments upon the experience of 1929 and its probable reflection into the future.

2. The approximate magnitude of the total production of the aircraft industry for 1930. If it seems inadvisable to give concrete figures, observations upon the considerations affecting total production and upon the probable general tendency (whether or not there will be a quick rebound during the coming spring, etc.) would be of marked interest. I should also like to obtain your views regarding the probable magnitude of pure replacement demand during 1930.

3. What must be done to keep production and sales in proper relationship without allowing factory programs to become unduly seasonal?

4. Observations upon desirable new markets, the feasibility of developing them, and the probable manner in which they will open up during the coming year. For example, I am eager for authoritative comments upon the probable rapidity of expansion of sales among true private owners, using airplanes entirely for non-commercial purposes.

5. As intimately related to the foregoing, the trend of types, and reasons for adopting the particular types of aircraft or engines which you favor. What is to be the relative standing of the two-seater and the three-seater? How are the open and cabin airplanes to share the market of the future?

The replies speak for themselves. So far as summary is possible, the general tone can be summarized as one of optimism for the future, combined with a high degree of caution and determination not to be lead astray into an excess of enthusiasm. Opinions on the

FOR *1930?*

Sales for This Year

probable continuance of the merger trend are varied, but the general feeling seems to be that it has run far enough for the present, though many of the small companies which are not in a position to present a product having any unique attractions will find the coming year an extremely difficult one.

The prevailing view is that production will run about equal to that of 1929, although in some cases a pronounced slump is forecast, while a few others look forward to so pronounced an improvement with the coming of spring that the total number of machines will appreciably exceed 1929's record.

Seasonal production is recognized as one of the industry's most serious problems, and no very complete solution is proposed. The possibilities of improvement most often suggested are in the development of airplanes which can be used with comfort and satisfaction throughout the winter in northern climates, or in a market analysis and forecast detailed enough to make it possible to risk building ahead during the winter months for spring sales.

There is no agreement upon the importance of the private owner, but the preponderant trend is to regard that market as something of a luxury for the coming year. It is agreed that it must be studied in detail, but most of the contributors feel that its wholesale effect upon production lies in the future and that airplanes must still be sold primarily for business purposes.

Naturally, impressions upon the trend of favor among the various types are influenced by the individual experience of the commentator. The past popularity of the three-passenger machine, which has been the specialty of a large number of companies, is perhaps projected forward into the future to reflect the natural desire of a manufacturer to continue with the product with which he has had most experience and which has brought him most success in the past. Putting that consideration aside for the moment, the apparent weight of testimony is towards the three-seater as against the two-seater machine, the latter having only a few very warm supporters, and it is very emphatically towards the cabin plane, except for training and certain other very specialized uses. Several replies emphasized the desirability of the two-seater with side-by-side seating arrangement for the private owner.

No summary can be anything more than a suggestion of the wealth of material that the contributions to the symposium present. They contain no deadwood. They are all interesting and important, and we heartily recommend that they be read as a whole.

Caution and Courage

By C. M. KEYS

President, Curtiss-Wright Corp.
Chairman of the Board,
Transcontinental Air Transport-Maddux Air Lines

OVERPRODUCTION of airplane models of many types was suspected during the summer of 1929, became obvious about September and, I believe, was corrected by the end of the year by the very drastic process of shutting down or curtailing to the minimum plants engaged in commercial production of planes and, to a lesser extent, of motors. Commercial motors are so much more nearly standardized and become obsolete so much more slowly than planes that the manufacturers feel fairly safe in keeping them in moderate production even at a time of overproduction.

C. M. Keys

The curtailment will probably continue until well on in the Spring, and longer than that unless clear signs indicate that the market has caught up to the supply.

In the early part of 1930 caution is the keynote of the trade. Working capital is being conserved, overheads are being cut severely, while expansion is being held down to only the amounts of firm contracts. Organizations are being made more compact and efficient and extraordinary efforts are being used in sales. It is characteristic of the new trade that was forced into a rapid growth that the Sales Departments were in large part merely takers of orders in 1928 and the early part of 1929. The real job of selling airplanes is just beginning to develop.

There seems to be plenty of courage and vision left in this trade after the great recession of 1929. The hope of the commercial end of the industry is the probable growth of private ownership and operation of planes, both large and small; the large for corporations and executive groups, and the small for individual pilots. One may look forward with some confidence to the development of a very substantial volume of new business in 1930 compared with any previous year. The best sign at the moment is the increase in the number of men taking training who do not expect to become professional pilots and make their living in flying.

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Better Transport Planes and Easier Flying

By GRAHAM B. GROSVENOR

President, The Aviation Corp.

THE COMING YEAR will see the aviation industry placing itself upon a firmer foundation and formulating sounder policies than have been possible in the past. In the year just ended there was much effort and money directed toward unsound activities. It would be a fallacy to say that no more money and effort will be spent in useless enterprise, but I believe 1930 will see generally a more wise correlation of efforts and expenditures and

the strengthening of the industry's financial foundation through further consolidation and the elimination of many ill-considered activities.

G. B. Grosvenor

Experience, which is the great teacher, has shown us that the majority of present types of airplanes used on airlines are uneconomical from the standpoint of the air transport operator. There is still much to be done by the aircraft designer and manufacturer to provide an airplane which can be operated at a minimum of cost and I look forward to much improvement in this respect during the coming year. The surface has barely been scratched in the matter of aero-dynamic efficiency and too much effort has been directed in the past to production in comparison with that directed toward refinement and improvement of design. Now indications are that the engineering of the airplane is receiving more of the much needed attention and that material improvement in efficiency may be looked for.

2. The first half of 1929 saw aircraft production activities expand beyond all reasonable bounds as a result of an exaggerated enthusiasm, leaving perhaps 2,500 unsold airplanes on the market.

This sobering influence will bring about a more carefully planned and regulated production of aircraft, and a more thoroughly organized and better directed sales effort.

Sales of aircraft for replacement purposes, with especial reference to scheduled air transport operations, probably will not be great. Many of the airline operators have found themselves with surplus equipment on their hands, and equipment in use during the last year was not flown enough in most cases to make replacements necessary. Obsolescence rather than wear and tear probably will be responsible for most of the replacements of transport lines during 1930.

3. The problem of regulation of production and sales to prevent undue seasonal slumps is a matter which requires serious study. Even the automobile industry with its much larger experience has seasonal production slumps, in which factories all but close their doors. Certainly the aircraft industry has an even more serious seasonal problem to consider.

4. Probably the largest present field for the sale of aircraft is that of unscheduled commercial operations. There, I believe, sales efforts can be directed most effectively for some time to come. In this country there are many hundreds of business organizations which could use aircraft to distinct advantage, but whose executives are not yet sold on the idea of flying or of maintaining an airplane. This field, it seems to me, has untold possibilities for development.

Development of the private owner field, I believe, depends largely upon the manufacturers themselves, and upon their success in bringing forth an airplane suitable for private flying—that is, an airplane comparatively safe in the hands of the novice; an airplane which the private pleasure-flying owner can learn to fly without undertaking a long costly flying school course. I do not believe that the field of the private owner will expand very widely until such an airplane has been developed and until price and maintenance costs can be materially reduced. Development and encouragement of gliding, I believe, will do as much as any one thing in preparing a fertile field for the privately owned pleasure airplane.

5. As to types of planes, there is no question but that the three-place open plane has a wider field of usefulness than the two-place ship. The two-place job has its field limited largely to flying instruction, while the three-place plane can be used both for instruction and taxi-hopping and is much more desirable as a pleasure plane. I believe that, as with the automobile, the closed cabin plane will find greater favor in the future than the open cockpit type. There are numerous reasons. The cabin ship is decidedly more comfortable, there is protection from the wind blasts and protection from cold in chilly weather. The cabin is easier to get in and out of than the open plane. There is more room, and certainly a cabin can be kept much cleaner than an open cockpit—a selling point with most women.

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Military Aviation—Air Mail—A Needed Readjustment in Progress

By FREDERICK B. RENTSCHLER
President, United Aircraft & Transport Co.

NEW PRODUCTION peaks were reached in 1929 by all branches of the aeronautical industry. To a substantial degree, this increase was due to healthy expansion, but to some extent excessive capital and misguided public interest were responsible. Literally speaking, those of us with longest experience in aviation, and whose confidence in its success made optimists of us for years, almost overnight became pessimists by comparison with the unwarranted optimism and beliefs on the part of less experienced individuals. Money and facilities were freely made available for both the sound and unsound equipment and transport projects.

F. B. Rentschler

As a result of the above, the readjustment period now occurring was only to be expected. Aviation is still a precise art, with success only available to the well financed, experienced organization, and with the premium still upon pioneering and engineering ability. The art is by no means standardized, but is moving perhaps more swiftly today, from a development point of view, than ever previously.

Military aeronautics is still the backbone of the equipment industry, and airmail stands in similar position with reference to transportation. Commercial aeronautics has made wonderful progress, and there is less question than ever that it is rapidly developing into a great new industry.

During this period of readjustment intelligent and conservative management is requisite. It is certainly unwise to build for stock or to force sales unduly. It is to be expected that in this period ahead the sound and unsound projects and organizations will be clearly indicated and the usual results will invariably follow.

It is believed there is more reason at the present time for complete confidence in the aviation industry than at any time during the twenty-odd years of its existence. Military and naval aviation have completely demonstrated their worth. Types of airplanes and of engines have been tremendously improved in every way, which makes the possibilities for purely commercial projects greater

than ever. With the readjustment period behind us, aviation within 1930 will continue to show remarkable progress and continue toward its goal.

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Sounder Financing and Larger Net Profits

By E. S. EVANS
President, Detroit Aircraft Corp.

THE INDUSTRY as a whole has just completed a very successful year in its history of growth, but judged by the standard of net income—which determines the success or failure of any industry—aviation has not been as profitable as we who are in it would like to have it.

E. S. Evans

We must remember, however, that this baby industry is now passing through its period of "growing pains" and is now "putting on its long pants" and is experiencing what all other successful groups have had to undergo in order to attain the sound business footing that will insure financial success.

Among other things, the year 1929 has seen several important moves toward consolidation and sounder financing, and it is entirely probable that 1930 will see further constructive action along these lines.

The aviation industry has discovered, through more or less bitter experience, that while its production methods may follow very closely those laid down by the successful automotive manufacturers, its income must be derived from methods more closely approximating those used by the railroads and steamship organizations.

There will be a good many more airplanes sold in 1930 than there were in the past year. One reason for this is the fact that flying schools will turn out nearly twice as many pilots in the coming year as were graduated in 1929, all of whom will be potential buyers or will fly for some private owner or transport line. Another reason lies in the fact that the general public is fast becoming air-minded, which will aid the market for aircraft as well as the organized transport lines in passengers carried.

A well organized sales department should eliminate the so-called dull seasons for the factories. This has been the most neglected phase of the industry due to the fact that after Col. Lindbergh's famous flight in the "Spirit of St. Louis" sales far exceeded production and no well planned sales program was needed.

The Detroit Aircraft Corporation, like all other large aircraft manufacturers, is constantly striving to improve its products, and has a large staff of engineers engaged in this work. Models will be changed from time to time as new improvements are discovered and thoroughly tested. New interior refinements will appear, as the public is demanding luxury and finish as well as performance in airplanes.

And, just as people are demanding closed automobiles, so will they demand cabin airplanes, and I believe that 1930 will see more of the closed types of ships sold than ever before. Of course the open ship will always retain its place as a training plane, and the ship of the type of the Lockheed Sirius that we built for Col. Lindbergh will always find a buyer in the sportsman, as will the small flying boat.

Through the medium of education, the public is gaining confidence in the efficiency and safety of aircraft. I firmly believe that nothing can prevent, nor long delay, the ultimate success of the industry.

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Conservatism and Lower Landing Speeds

By TEMPLE N. JOYCE
Vice-president in Charge of Sales, Berliner-Joyce Aircraft Corp.

TO PREDICT with any reasonable degree of accuracy the trend of the aviation industry is almost an impossibility at this time. With the adverse influence of two major factors, the stock market decline and the general breaking down of the whole over-developed commercial picture, the industry finds itself with defunct companies throughout the country flooding the already overproduced market with their orphan planes; many disillusioned, young student pilots who cannot find the promised jobs; and the general public fed up on the enormous amount of ballyhoo and unsavory crashes in all phases of operation.

I cannot too forcibly express the opinion that the industry has got to come down to earth. Everyone cannot fly, and the majority of our people will not want to even as passengers for some years to come, or until safer planes are built. Aviation is naturally more dangerous than other methods of transportation, as increases in speeds in the past have always brought about added risks. During the past year the air has had more than its share.

Temple N. Joyce

Why? Because aviation caught public fancy, particularly that of the purchasers of securities, and larger sums of money were made available than the competent aviation executives could take care of. An influx into the industry of personnel who knew nothing of air operations resulted, and in addition many visionary young pilots were suddenly expected to assume and carry out the duties of conservative management. It is quite natural, with this state of affairs, that the industry should find itself as it is today. It would be better to let the industry shrink within itself during the coming year, and let the demand exceed the supply, rather than repeat what we have just gone through. Building upon definite commitments from distributors and dealers, in place of wild hopes, would tend to curb over-production.

The art is advancing too rapidly, and the demand is too small, to get anything like production. These two factors will undoubtedly increase prices and still further cut down demand. Let us not be carried away by the rosy picture of the automobile industry; too often we draw an analogy between the automobile and the airplane. The growth of aviation can be better likened to the motor boat and shipbuilding industry, where private activity is on the increase, and the biggest outlet for planes during the coming year should be in the private-owner class. Accidents caused by bad weather should be less in private activity, due to the lack of that impulse to push through which has been the cause of numerous air transport

crashes. Lower landing speeds prevail in this class of plane, but should be still further cut down in order to reduce the bad influence of recent accidents.

There are two major items that will bring about better conditions, particularly in private flying. First, the proper training of personnel to use their heads in avoiding trouble rather than to depend upon clever handling of the stick when it overtakes them. The action of the Department of Commerce in rating schools will probably be of the greatest influence towards bringing about a proper training of personnel.

Second, reduction in landing speeds in all classes of aircraft. It appears to the writer that we have gone crazy over top speeds which, in the absence of any new aerodynamic developments, naturally bring high landing speeds. Our airports, with few exceptions, are too small and our landing speeds too high. We persist in closing our eyes to the probable serious consequences of motor failure just after take-off when beyond the safe landing limits of the airport, and pray to God that this misfortune may not overtake us. This military pilots' psychology must be eliminated from commercial aviation. Railroad operation under similar conditions would be in a pitiable state of affairs. One is sure that the railroads do not run their trains on the hope that the maximum critical condition may not occur. To make an aircraft land at 60 or 70 m.p.h. is only courting disaster, particularly when it is expected to put this type of plane in the hands of the average man. Operators who countenance such landing speeds in air transport operations, and designers who lay jobs out, should be introduced to a few forced landings, either just after take-off or over unfavorable territory. They might modify some of their conclusions subsequently.

The success of the Curtiss Tanager in winning the Guggenheim competition is a great credit to that company, particularly with regard to cutting down landing speed, and is a fine example that should be emulated by the other manufacturers in this country.

To fly is to use our wings instead of the engines. Let us have more wings.

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Making Flying Simple—Selling the Idea to the Public

By ROBERT E. LEES
Sales Manager, Waco Aircraft Co.

A YEAR AGO TODAY, our outlook toward 1929 was much the same as it is now toward 1930. At that time we faced the problem of selling a much higher-priced airplane than in previous years, and it further will be recalled that the previous autumn of 1928 had also shown a decided falling off in retail business.

We feel that we are in a better position this year due to the fact that stocks of new Waco airplanes here at the factory and in the hands of distributors and dealers are much lower than they were a year ago today. It is true that we all will have to sell airplanes this year, but the first thing that we will have to sell the public is that flying is reasonably safe and reasonably easy. The rest will follow.

2. We expect our 1930 sales to exceed 1929, owing to the availability of good new production motors at lower prices.

3. This industry still seems to be a seasonal one, although, of course, export selling in the southern hemisphere will help balance it as will the production and development of airplanes that can be flown with pleasure in the winter time.

4. As closely as we are able to determine, about half of the Waco airplanes sold in 1929 went into the hands of private owners, and this market will increase with reasonable rapidity as fast as we prove to it that flying is inexpensive, safe and easy. In this connection, it must be remembered that many operators and pilots have been forced to make their living through the sale of passenger rides and student instruction, and success in this effort makes it necessary to prove to the public that flying is expensive, very difficult and thrillingly dangerous. This puts the average retail sales dealer and operator on both sides of the fence at the same time, but the ones who have specialized in airplane sales are beginning to discover which side is the most profitable, and have found that the public is very much delighted to learn that flying is reasonably economical, safe and that the average human being can learn to fly in reasonably fair weather.

5. We favor the three-seater for the reason that it can be sold at a price very little higher than a two-seater and that it has an all-around commercial and resale value.

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Effect of Mergers—Awakening to Some Hard Facts—Need for Lower Transport Costs

By SHERMAN M. FAIRCHILD
President, Fairchild Aviation Corp.

THERE IS NO DOUBT that great technical advance is going to be made in airplane design in 1930 and the years thereafter. The possibilities of really scientific engineering have never been fully used. Such scientific engineering requires expensive wind tunnels, model basins and large engineering staffs, which can only be justified by organizations with large production and capital to do the research and pay for it before returns on this money are obtained from the sale of the improved airplanes. This would indicate that airplane production would be concentrated in a few of the larger groups.

S. M. Fairchild

In contrast to the situation in the automobile industry, there is no such thing as an assembled airplane. Most of the small automobile manufacturers depend on almost complete assembly of their products. No such condition exists in the airplane industry to aid the small manufacturer. It must be said, however, that performance is not the only requirement for some small and cheap planes, and in these classes we will have the independent manufacturer.

Probably the biggest general change in the industry for 1930 will be the tendency for the large manufacturers to market the airplane and the motor as a whole. This means that airplane motor manufacturers who are also airplane manufacturers will be unable to sell their motors to independents, providing the independents can buy motors as good, or almost as good, from independent motor manufacturers. This situation is a natural one. At the present time, independent motor manufacturers

cannot supply motors of all sizes. However, it is only reasonable that the independent manufacturer will prefer not to build up a competitor's business through the purchase of his motors. All of these facts tend to show that at least 75 per cent of the airplane production of this country will be concentrated in the five or six larger groups. Sales and production will undoubtedly be placed on a more scientific basis. There are at present altogether too many dollars of capital used for one dollar of sales, and if any real earnings are to be made this condition will have to be reversed.

2. Aircraft production for 1930 is faced with the situation that there are from 1,000 to 1,500 planes which have never reached the ultimate consumer. Although they are not all listed in the manufacturers' inventories, they have been sold to allied organizations and have not yet reached a user. In addition to this, another thousand airplanes were purchased by organizations that have no real use for them and are now finding it out, and they will undoubtedly come back on the market. I refer to transport organizations who are now finding out that they cannot make any money out of air passenger transport. We are, therefore, starting 1930 with 2,500 airplanes to get out of the way before we can start. Aviation is a luxury and with present business conditions in the country, and with people having less time to play, I see no reason why there should be a sudden demand for airplanes. Therefore, I feel the total demand will be around 7,000 planes, of which 2,500 have been produced, so that we may expect to build from 4,000 to 5,000 new airplanes.

3. If there is any one item which is needed in the airplane industry it is an actual forecast of sales by months. A forecast by the industry will allow production and inventories to be kept in much better relationship than in the past.

4. There is a great deal of misconception about the use and possibilities of the airplane, much of it due to over-enthusiastic advertising on the part of the aviation manufacturers. Business houses are now finding out that they cannot profitably equip all of their salesmen with airplanes and that getting there by airplane does not get them the order while their competitor is traveling on the train. In the same way regularity and comfort of air passenger travel does not compare with the glowing statements in the advertisements. Business houses will undoubtedly use airplanes and there will undoubtedly be air passenger lines. However, I do not feel that new uses for airplanes will count for any great increase in demand. Many business houses used airplanes because of their novelty, and the newspaper publicity which they obtained really paid the cost of the plane. As airplanes are no more a novelty, this publicity is falling off and it will, therefore, be more difficult to get advertising managers to charge the cost of planes into their budgets.

The biggest problem which faces the industry in 1930 is the question of some outside support for the air transportation lines. There is no question in the mind of any air transportation executive who has made any real study of the proposition, that he cannot depend on more than 50 per cent loads and that he is lucky if he obtains that average. Under these conditions air transportation costs from $.20 to $.25 per passenger mile, and it is being sold at from $.5 to $.12 a passenger mile. If some outside help is not brought in to make up this deficit, air transportation will probably fail, and the public generally will become disgusted with the aviation industry. Large airplanes, intensity of service and aerodynamic improvements will undoubtly reduce the cost of air transportation, but all of these items together cannot possibly affect these costs over 25 to 30 per cent in the next two years and, therefore, the only solution lies in finding some way to raise the income.

5. It is difficult to predict the trends in design. There is a tendency toward monoplanes, especially in the cabin field. There is also a strong tendency toward in-line engines, and a survey of the market indicates that the aviation public is sold on and will welcome in-line engines. When all is said and done, there is little money to be made out of the purely school plane, and, therefore, a three-passenger plane has better chances for making money on the side when not being used for school instruction than the two-place, and there will be a demand for it.

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Let Markets Control Production— More and Better Statistics

By B. G. LEIGHTON
In Charge of Sales and Service, Wright Aeronautical Corp.

IT IS SUPERFLUOUS, perhaps, to say that the trend of the industry is definitely and inevitably toward merging into larger units the various smaller units that have been in existence in the past, with a rapid weeding out of the less efficient or less strongly financed manufacturers. With the great excess of producing capacity over possible immediate demand we have a highly competitive industry, with all producing organizations bidding strongly for the limited market and operation on an extremely narrow margin of profit or at a definite loss. Those who are not very strongly financed will find the sledding very hard indeed.

B. G. Leighton

The sales force is becoming and will become increasingly important, and must inevitably take a position of predominating importance. That is to say, the selling organizations must stand in relation to engineering and manufacturing organizations, not as a force to sell what the engineering and manufacturing forces choose to build, but as an agent which will direct the activities of the engineering departments and dictate production schedules to the manufacturing departments.

2. I am not at all pessimistic about the market for 1930. 1929 has shown a substantial and steady growth in the use and sale of aircraft over 1928, of course. There is every indication of a normal continuation of that growth in 1930. I should place the probable market for 1930 at between 8,000 and 9,000 commercial airplanes of all classes.

The "slump" of this fall is, of course, partly a normal seasonal phenomenon but it has been greatly accentuated by numerous other factors such as: (1) The die-hard spirit of many manufacturers who refused to believe that their initial market estimates had been far too optimistic and who continued building in the face of warning signals until they had rather badly over extended; (2) Formation of numerous new airlines during the spring and early summer which gave an artificial stimulus

to sales in the early part of the year followed by a rather abrupt recession as realization came that the public is less ready to ride as yet than early estimates led operators to expect; (3) The stock market reaction; (4) A general discarding of the rose-colored glasses that were so generally used early in the year to look at all matters pertaining to aeronautics, and a general pausing to take stock, etc.

I doubt if there will be a very great demand for pure replacements during the coming year. Many operators are already overbought on flying equipment. Few of them have as yet actually worn out the new equipment which has been bought during the past year.

I look for a steady increase in sales throughout the spring and summer, with a recession about October, but not nearly so great in proportion as has been the recession of this fall.

3. The foreign market is, of course, always a strong factor in smoothing out seasonal variations, but of even more importance is the development of accurate statistical information as to what actually is going on. The absence of accurate statistical study of production and actual sales in various types and in the various power and price classes is the greatest handicap of the industry today. The Aeronautical Chamber of Commerce has a real mission to perform along this line.

4. I do not look for any very great market among true private owners in 1930. I believe that expansion will be greatest during this year in the "executive transportation" class. Service facilities and salesmanship have not yet progressed sufficiently and types and prices have not yet become sufficiently stabilized to offer great encouragement to the truly private owner. There will unquestionably be an increase in the private owner class, but it will be principally confined to the luxury or sporting class. The general tendency of the prospective private owner is still strongly to "wait and see."

5. In passenger transport there will be experimental use of much larger multimotor types, but no very great market. I expect to see a rather wide spread adoption of smaller six and eight place single engine types—actuated principally by motives of economy and efficiency, on the theory that more frequent schedules with smaller loads will net larger volume and greater revenue.

In executive transportation the four or six place single-engine cabin monoplane of moderate cost seems to occupy the favorite position, because of the moderate initial and depreciation costs. I can't hold out a great future in my mind for the open two-seat tandem arrangement, except for training and purely sport flying purposes, because all men love company and few like to ride for any great length of time in silence without human contact. The open three seater is an improvement on the two seater in this regard, but will persist in considerable volume only so long as it is distinctly cheaper than the cabin type.

There is little question that the cabin type will steadily encroach upon and eventually largely displace the open cockpit type. Reasons: (1) Less noise and confusion; (2) Greater comfort—heaters for winter, absence of helmet and goggles, no special clothes required, etc.; (3) Greater companionship—conversation practicable, and side-by-side seating arrangement.

There is undoubtedly a good market for the two-seater "chummy" cabin type because of its low price, but there will be an inevitable trend toward the four-place cabin type of about 200 hp.—for the same reason that the five-place closed sedan is so popular in the automobile market.

In engines, I believe, we will stick to air cooling, because of decreased complications, but will tend toward inverted Vee or in-line engines in the larger power classes because of demand for higher speeds, better visibility and smoother operation.

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Cultivate the Easiest Markets First—Good Replacement Demand—Seasonal Problems

By WM. B. ROBERTSON
President, Curtiss-Robertson Airplane Mfg. Co.

THE MOST IMPORTANT question that is before us now is that of sales. Factories have caught up with the demand and have overproduced. Heretofore, it has been an easy matter to sell an airplane, as the demand was greater than the supply; now it is not such an easy matter. Airplanes will have to be marketed in a manner similar to that of the automobile. The factories are rapidly realizing this and are establishing their distributors and dealers in the territory, who are either owners of flying schools, taxi lines, and established aviation operators, or are automobile distributors who are starting an aviation department.

I have made an exhaustive study of the general market and have broken it down into three groups, each of which must be approached in an entirely different manner, as the information that would be of interest to one group would not be of particular concern to the others. These groups listed in their importance are:

Group 1. Those who are now interested or connected in some way with the aeronautical industry, namely 28,000 students in training, some 8,000 licensed pilots, some 12,000 licensed mechanics, and the airline and air-mail operators. I believe that this group is the immediate market. This group is already airminded and interested in the technical angle, as its members know the difference between tail skid, top speed, cruising and landing speed, as well as other performance data, particularly the cost.

Group 2. Next in importance are the business houses. There are hundreds of thousands of corporations and business establishments that would be more than willing to use an airplane in their business if they could be convinced of the actual economy of the airplane, through demonstrations. If they can increase their sales, and incidentally their prestige by employing the airplane, the profits will follow. I firmly believe that more business houses would use the airplane, if they could be convinced that it would be of real service to them. This can only be done through demonstrations.

Group 3. Those gentlemen who have plenty of money and fly only for the sport of it, members of exclusive clubs including the yacht clubs throughout the country, who are lovers of outdoor sports.

I prepared separate sales letters which I used some months ago in reaching each of the above groups.

Answering your questions outlined in your letter, I am pleased to advise my views on the subjects contained in each question as follows:

1. I believe that the probable trend of the industry for the coming year will be towards further consolidations, merging of executive, engineering and factory management personnel, and elimination of unnecessary

expense wherever possible. It is my hope that the coming year will bring about such mergers, consolidations and eliminations as are necessary to put the industry on a safe financial and industrial footing so that its growth from now on will be natural and healthy.

The experiences of 1928 and 1929 have proved that there are too many aircraft companies organized and operated on a limited capital, and during the seasonal depression these companies naturally will go out of business, leaving different types of airplanes in storage throughout the country which will have to be thrown on the market at any price, reflecting on the entire market adversely.

2. As to the number of planes and engines that will be built during 1930, it is impossible to give any concrete figures, as one person's guess is as good as another's. I do believe, however, that there will be approximately 75 per cent replacement demand during 1930, due to the fact that the new models coming on the market will be of such marked improvement in performance and economical operation that these features cannot be overlooked by the operators. My belief is that we can look forward to a demand possibly as great as we found in 1929.

3. The problem of keeping production and sales in the proper relationship is one of great concern to me, possibly because I am on both sides of the fence, namely as president of the Curtiss-Robertson Airplane Manufacturing Co. and vice-president of the Curtiss-Wright Sales Corporation, assisting Mr. Beech in the sale not only of the products of this factory, but the products of the other factories in the Curtiss-Wright group. I find that this is the problem of the hour.

Surely we cannot expect a distributor or dealer who so far has not made any money out of the distributorship of airplanes to sign a contract and live up to that contract by taking ships from the factory during the dull season in order that the factory may be kept running on a regular schedule.

Of course the ideal situation would be to have the factories run on this schedule the year round and the distributor take the ships from the factory as they are manufactured. The past years have proven to us that this cannot be done and it seems to me therefore that the problem is that of the factories, at least for the present. There are two alternatives, I believe: one is to shut down the factories during the seasonal slump and open again in the spring, and the second is for the factories to manufacture the least number of airplanes in order to keep the wheels going and store the ships until the demand opens again in the spring. Both of these alternatives have serious disadvantages. If the factories shut down there is a certain amount of overhead and other expense that goes on just the same, on the other hand it would be unwise to continue manufacturing one or two types and fill the warehouses with these two types only to have them far outclassed by new models which are placed on the market in the spring. We are giving this problem serious consideration and hope that the solution is not far distant.

4. I believe I have already answered these questions.

5. I believe the trend of the types of airplanes is toward the cabin type for business houses and private owners, and open types for training ships and airmail and special flights where the arrival on time is all-important. I believe that the two-seater open cockpit plane will always be in demand as a training ship and that the three-seater open cockpit plane will not be in use as heretofore as it will be replaced by the cabin plane for short passenger hops, and that four-place cabin planes will find a very ready market in 1930. I believe also that the six-, seven-, and eight-place ships that are on the market now are entirely too expensive, both in original cost and operation, which will result in the appearance of a popular priced twin-motored cabin plane.

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More Intelligent Merchandising— Effect of Insurance Costs

By B. F. CASTLE

President, Great Lakes Aircraft Corp.

IT APPEARS TO ME that the trend toward consolidation in the aircraft industry will continue. At this time it is obvious that consolidation with strong companies is the only thing which will save many of the smaller companies from total extinction.

B. F. Castle

Undoubtedly, the administration of aircraft corporations in 1930 will be more economical than it was in the early part of 1929, when companies were long in cash and short in inventory. It is quite probable that the reverse of the latter situation is now true and that management is perceiving how difficult it is to maintain a liquid position and, therefore, how necessary it is to eliminate every expenditure which is not vital to the efficiency of the organization.

Competition for government orders will be very intense because of the fact that much commercial business which was anticipated by manufacturers has failed to materialize. In order to keep their factories moving they are looking to government business.

Production for 1930 should be about the same as in 1929 and I feel that at the end of 1930 the story will show that inventories have been greatly reduced and that the companies in the industry are as a whole in a much more liquid position than they are today.

It seems to me that the outstanding characteristic of 1929 was the failure of the aircraft industry to analyze its market and to plan a real merchandising program. Undoubtedly in 1930 sound merchandising principles will be applied. The commercial market for aircraft, while not large, is adequate for the production facilities of the industry as they exist today. However, the market is one which is difficult to develop and the costliness of sales is one factor which should be reckoned with in price fixing for the 1930 calendar year. Examining the prices of aircraft one cannot help but feel that there has been a failure on the part of the industry to properly evaluate the cost of engineering, administration, and sales. Otherwise, the prices which have been fixed by certain companies must reflect a determination to take substantial losses on initial production.

The gradual expansion of the export field, particularly in Latin America, has been very marked during the past year, and it is my opinion that there will be continual progress in this direction. American manufacturers have a logical advantage in this field and if they organize properly for sales they should develop a very interesting outlet for their surplus in the years to come.

The financing of sales, both for export and in the domestic field, on the time payment plan will make progress during the coming year for it is now a fixture in the economic life of this country and in foreign countries where American motor cars are sold. The aircraft industry cannot afford to overlook this factor.

One of the greatest deterrents to sales is the high cost of insurance and it would seem that the Aeronautical Chamber of Commerce could not devote itself to any more constructive topic than that of determining ways and means of reducing the cost of insurance to individual users and to companies.

Sales to private owners should expand if the experience in England is any criterion. In England it is smart to fly and it would appear that through the medium of the Aviation Country Clubs in this country the sportsman pilot is rapidly becoming aware of the pleasure and time saving which can be his through the use of his own plane.

I feel that for the sportsman pilot the open cockpit type will remain in the primary place of favor. However, for business and family use we can be sure that the cabin plane with a minimum of four passengers inciuding pilot will see greater and greater usage. The two-place open cockpit plane will overtake in popularity the three-place open cockpit plane as the latter must necessarily be out of the light plane class which means greater horsepower and, therefore, higher maintenance cost.

1930 will be a year of elimination of the weaker aircraft companies, maintenance of sales volume as compared to 1929, reduction of operating costs, expansion of the export market, improvement in design of planes for the individual owner and a larger use of the smaller type of cabin plane.

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Export Development and Accident Prevention

By PAUL BECKER

Ass't Sec'y, Chance Vought Corp.

IT IS OUR FEELING that during 1930 satisfactory progress will be made by the industry as a whole. It is not believed that any radical changes will be made in design and production, but that the usual progress and improvement will be made in these factors of the industry. We believe that the sales for 1930 will somewhat exceed those for 1929, but do not endorse the prophecies for rapid expansion of sales which are coming through some sources. We still believe that the military program is important and will remain the background of the industry.

2. We believe that 1930 production will remain on an even keel. We feel that 1930 will be a year of combinations and eliminations in the industry. In other words, that it will result in a survival of the stronger groups and the dropping out of the innumerable companies which have sprung up in the last few years, a great many of them without proper financial backing or a product which merited continuation.

3. Production and sales for the year can be kept in proper relationship only by careful and conservative survey of probable sales, and the elimination of over expansion in production. Each company should produce only such ships as it has a certainty of selling within a reasonable period.

4. New markets for aircraft cannot be opened up over night. However, we believe that a real field for American aircraft is offered in the export market, and that substantial increases in sales can be made in this field by proper coverage and intensive effort.

5. We do not as yet see an accurate picture of the future as to the general type of aircraft which will be predominant. We feel there is a field for both the open and cabin type plane. However, in the back of our minds remains the idea that the real future of the aircraft industry is in rapid transportation of goods and passengers.

We feel that during the year a real effort must be made by all connected with the industry to build up public confidence. The recent numerous accidents have undoubtedly destroyed a good deal of the advance which had been made along these lines. Actually it seems to indicate that the greater portion of accidents are due to the personal factor, namely, negligence, carelessness, over-confidence and inadequate training. We believe that a great deal can be done within the industry itself to eliminate this factor and that the day of the so-called "daredevil aviator" is past.

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Research, Light Planes, and the South American Market

By WM. B. STOUT

President, Stout Metal Airplane Co.

ON THE EXPERIENCE OF 1929 in sales, 1930, I believe, will be largely a question of marking time with present day planes and equipment, and building up what market we can, while all who are wise are continuing feverish research to develop types which will fit the market instead of trying to force the market to take the types not suited to its needs. The field for present day airplanes is comparatively small. The field for future designs will be practically unlimited. Those firms will prosper most who carry on the most construction research. Sales for 1930 should surpass sales for 1929.

Wm. B. Stout

2. Production will surpass the the number of planes already on hand, if my guess is worth anything, by about the figure of the total number of planes that were sold last year. Replacement demand during 1930 will be comparatively small.

3. Production and sales will be kept in proper relationship by designing a plane that can be used safely during the entire year. As long as the use of the plane is seasonal, sales will be seasonal.

4. New markets are available in small super gliders for the flying of fledglings who are not quite up to piloting big ships, but who have passed the glider stage. Markets for present day planes are available only where these types fit conditions. It would be a mistake to sell our present type airplane to foreign countries in any quanaities unless they are suited to the topography, psychology and requirements of these countries. I am thinking particularly of South America as the greatest future airplane market. The expansion of sales among true private owners depends entirely on someone developing

a plane suitable for the private owner in which he can fly home after five hours' instruction.

5. Radial air-cooled engines will continue in favor of up 500 hp.; from there and beyond we will see the coming of water-cooled or prestone cooled, diesels and real sized power plants for large planes. For the private owner, the small radial engine of 100-150 hp. will continue in favor. The water-cooled engine is definitely out except in large sizes.

Regarding the two- and three-seater: a two-seater plane is only a training plane. The most popular type will be the plane capable of carrying two and baggage and five hours' fuel with the possibility of making it a three-seater without baggage for shorter trips.

Open and cabin planes will both continue, but for all-the-year-round work, closed heated cabins are lighter, faster and more comfortable than a fur-lined flying suit with all its weight and cost and discomforts. A private owner will demand side-by-side seating.

In the matter of these things, the public is the group to be listened to and not the pilots. Our problem is to give the public the thing it wants.

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Learn from Automobile History

By WALDO D. WATERMAN

Gen. Mgr., Los Angeles Metropolitan Airport

ABOUT TWO YEARS AGO the few commercial aircraft manufacturers found that no matter what they built, if it flew, there was a buyer waiting at their factory door for the product. This condition caused scores of new aircraft manufacturing organizations to spring into being, madly working towards the production of more airplanes. The facts that they would fly, have a reasonable performance, and were not structurally unsafe seemed to be the prime requirements; but little thought was given to the question of who was going to purchase this large number of planes which were suddenly produced, or what those buyers' requirements would be. It was generally believed that the average man of above moderate means would purchase these planes in large quantities.

He has not done so, with the result that we now find scores of aircraft manufacturing companies loaded with over-production and with their organizations, which they strove to develop rapidly, suddenly pruned to mere skeletons; and we find our infant industry with a serious case of "rickets."

Many are of the opinion that little constructive merchandising effort has been expended, and that the industry's only salvation this coming year is for intensive educational and merchandising campaigns to sell its product. It is true that such efforts may bring some results—as with high pressure salesmanship methods silk pajamas can be sold to Eskimos—yet it is obvious that the silk pajama industry would soon perish if dependent upon the Eskimo trade.

Many times the aircraft industry has been compared to the automobile industry of twenty years ago. This seemingly trite comparison is obnoxious to many in our industry, although there have been hundreds of instances in which automobile history has repeated itself in aviation.

Twenty years ago there were scores of small automobile factories building automobiles which "just ran." A trip of one hundred miles or more was a great adventure unless the driver was something of a technical and practical superman. About this time Henry Ford, who had been building automobiles in a small way along with the rest of them, took the same old parts that everybody had been using to build automobiles and turned them around in a different way, producing the famous Model "T" Ford, which was more flexible, more foolproof, and required much less judgment on the part of the driver to successfully operate it. The price of the first Model "T" Ford was not appreciably lower than other automobiles of similar size and horsepower, but it immediately supplied a demand for an automobile which could be successfully and economically operated by inexperienced drivers. The result was that this car immediately came into popular demand with a resulting increase in production and a corresponding drop in price.

The production of Ford cars grew like a snowball and as production increased, prices descended to a level never before contemplated. The whole country immediately became "motor car minded," and through the medium of the Ford car the present generation has been educated to the automobile. This education has grown upon the public and has been developed to a point in recent years where the public no longer needs an automobile as foolproof as the original Model "T" Ford, with the result that the famous line was discontinued and in the new model produced we find many features which were not unknown twenty years ago, yet were applicable only to the more educated motorist.

Aircraft designers can well take this example as a lesson. Experienced pilots and people who can afford to hire pilots have purchased our present type of aircraft to the limit. We must now build airplanes that are more flexible, more foolproof, and that require less judgment and operation than our present types before we can expect the volume of sales which can only be brought about by the extensive use of airplanes by the average man.

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Lower Prices and Year-Round Flying

By C. V. CESSNA

President, Cessna Aircraft Co.

IN REGARD to the probable trend of business for the coming year, I have a feeling that the cheaper planes will find the more ready sale, due to the fact that all business is following more conservative lines and watching expenditures more closely than heretofore. However, I feel that transportation business will be for even larger ships. In my opinion, there will be two classes—one in the smaller and cheap class and one in the larger, even larger than perhaps any now being built, which will be most in demand.

My experience with 1929 I am sure did not differ from many others, in that money was free and business easy, in fact too easy for the good of the industry, which I think is to blame for the temporary slacking up of our forward progress. I feel sure that everything is going to be all right, and the approximate magnitude of aircraft production for 1930 will no doubt be as great as last year. I do not look for a fast comeback, but rather a slow conservative re-establishment of the prosperous condition which we have just passed, which will only be brought about by those who have determination and foresight to get down to business and handle the aviation industry as all good sound business is being handled.

In other words, I feel that in order to accomplish what was done last year, all of us need to put forth our best efforts toward better business methods and conservative action.

I feel that the aircraft industry can be likened somewhat to the automobile industry—that we have reached a stage where there will be quite a number of trade-in sales for those wishing better ships. One of the important considerations in the aircraft industry in order that we may have an all-year-round business is to arrange for more comfort for winter flying. This can be done through the use of cabin planes, paying particular attention to the seats, ventilation, heating and light, as the traveling public, will expect the same of airplanes in the way of convenience and comfort as they are used to in automobiles, which at one time were seasonable vehicles very much the same as planes are today. The problem is very similar—what worked with the automobile will work with the plane, and that is convenience and comfort for all-year flying.

Also, airport facilities for servicing and shelter will have no small part in bringing the all-year ships. All-year service will, of course, contribute greatly to the healthy condition of the aircraft manufacturing industry. There can be much done in the way of developing new markets in foreign countries, to which we have heretofore paid too little attention, but I am quite sure many wide-awake manufacturers are looking to foreign trade at this time and will no doubt meet with much success if they follow an energetic program.

There will be, in the future, large quantities of airplanes sold to private owners, and to various businesses such as the oil industry. Competitors in like occupations will be forced to follow suit, as was the case in the automobile industry, when those using horse vehicles were forced in line through the speeding up of all business brought about by the automombile. Competition will make business accept the airplane in the same way.

As before stated, the most popular sizes of airplanes will be the small business mens' planes for private use, and large transport planes for commercial use. There will not be much field for those in between. I liken this to the automobile industry, where demand is either for a small private car or a very large bus. My conception of the popular ship will be the two- or four-place size, for they really fit in most conveniently for all business purposes.

The one other main feature, of course, is speed, for after all that is the only reason for flying.

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Steady Progress Anticipated, but Many Companies Will Disappear

By E. E. PORTERFIELD, JR.

President, American Eagle Aircraft Corp.

THE PROBABLE TREND of the industry for the coming year, I feel certain, will be an improvement in the manufacturing business, particularly in multipurpose, small planes, adaptable for student training and passenger carrying. Another type, which I believe will show a large gain during 1930, is the cabin monoplane from four to eight place. In 1929, I beliece there were more students trained than in any two previous years. I can see no reason why 1930 should not show as much gain over 1929 as did 1929 over 1928.

To the best of my knowledge, there are 212 aircraft factories, including those who are starting and hoping to get into production. Of the 212 now in the field, probably 30 will live through 1930. This should make a healthy condition for those which remain, as the manufacturer making eight, ten or twelve planes a year will doubtless step out of the way to make room for a better business for the factories which have adequate sales and engineering forces. A competent engineering force naturally is the successful foundation for an aircraft factory, and the sales force and distributing organization represent the supperstructure. Both are very necessary, and without them, in my opinion, a factory can get nowhere.

Mergers should take place in a wholesale manner during the late winter, spring, and early summer. Some of the weaker factories have good ideas and designs which can be worked into a going factory and lend considerable strength to stronger brothers.

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A Detailed Analysis of Probable Sales

By R. B. SNOWDEN, JR.

President, Command-Aire, Inc.

THERE IS very little outstandingly new in the industry for the manufacture in the past year's developments. However, there are many refinements and minor developments for improving the quality and reliability of our present day airplanes. Treating the matter from the standpoint of one who is interested only in the production of relatively cheaper priced airplanes, I have recently made a very careful study of the probable production and possible outlets for ships priced at $9,000 and down. I have taken into consideration the number of factories in last year's production race, the facilities of each, their probable most successful model, around which they will center their efforts, and in each case I have given relative value to the logic of the merger developments of the past year, the inventories carried over, the preparedness of each company, its financial strength and the position that it now holds in the industry. The net result leads me to believe that an outlet will be found for approximately 4,700 new airplanes at list price of under $9,000 (see table next page).

R. B. Snowden, Jr.

I feel earnestly that most of the carry-over 1,700 shop-worn or second hand planes will be sold at prices under $3,000, and this fact makes me feel that Group 1 in the following table will be the smallest group in the first four. I have arrived at seven main groups and each factory, by virtue of the price of its product, is put in one or more groups. Then I have given an A,B,C rating to each factory depending upon its facilities for production and price. I have made what I feel is ample allowance for new price reductions, which we all feel will be inevitable in the industry. As for outlets, I feel confident that this many airplanes will not only be built, but readily salable. Undoubtedly the domestic and export markets will be enlarged.

The first signs of spring and sunshine will overcome the present gloom with which we are all imbued. The

flying schools must have replacements, past owners will want something a little better, and the new graduates must be served in their desire to fly. There will be strenuous price reductions, and probably unheard-of bargains; and these bargains will be greedily pounced upon by many of those who were smart enough last year to stand off and watch the show go on, awaiting the proper opportunity. I do not feel that the sale of these bargains will interfere with the new plane market. I feel only that it will enlarge the new plane market by adding new names and new faces to the flying personnel of the country. I cannot look toward 1930 with anything but optimism.

Group 1 ($3,000 and under)	500
Group 2 ($3,000-$4,000)	1,550
Group 3 ($4,000-$5,000)	1,300
Group 4 ($5,000-$6,000)	575
Group 5 ($6,000-$7,000)	325
Group 6 ($7,000-$8,000)	300
Group 7 ($8,000-$9,000)	152
Total	4,702

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Hope for a Good Year and for Increased Private Flying

By WALTER H. BEECH
President, Curtiss-Wright Sales Corp.

THE PROBABLE TREND of the industry for 1930 is, in my estimation, to be in the nature of an upward swing. In the past few years a sound foundation for the manufacture, distribution and utilization of the airplane has been laid and, in spite of the fact that we are not in a boom period, indications point toward a wider public acceptance of aviation this year. Our organization has profited greatly from past experience and we feel sure this opinion is well founded. We now have an engineering research division whose function is the development of advanced types. Sales trends and efficiency in production are important considerations in this development work and there will always be Curtiss-Wright planes available for each new step in the commercial operation of aircraft. I feel that commercial transport work will increase greatly during this year and that private flying will also be more popular.

2. I would not care to make a concrete prediction as to the total production in 1930, but I do believe that there will be some increase in the new plane production over 1929. Furthermore, I believe that there will be a general stimulation of aircraft sales following the International Aircraft Exposition in February.

3. In order to maintain the proper relationship between production and sales, it will be necessary to analyze markets more closely, to better educate people as to the valuable uses to which airplanes may be put, and to maintain proper factory control at all times. Due to the fact that airplanes are not yet turned out quite as fast as other production commodities, I believe it will become possible to maintain more uniform production at factories, despite the seasonal nature of the business.

4. I do not think there is any question but that private sales will be stimulated in 1930, though not in the proportion they might be if financial conditions were somewhat different. There are undoubtedly a large number of people with means who will join the ranks of airplane owners when the advisability of such a step has been properly put before them.

5. In regard to type, there is no question but that the closed cabin plane is coming into favor more and more as people in general become interested in owning planes. In the past year the ratio of closed to open planes was about 40 : 60 and this year I am sure the ratio will be at least 50 : 50.

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Moderately Increased Production—Better Co-ordination of Sales and Manufacture

By W. B. KINNER
President, Kinner Airplane & Motor Co.

WHILE I WOULD NOT CARE to state in concrete figures the amount of business which will be done in 1930, I do think there will be a quick rebound during the coming spring, and the probable trend of the industry for the balance of the year will be steadily upward and will gradually level out on a more stable basis. I should say that on the whole the construction programs of the principal commercial aviation companies during 1930 will be at least 70 per cent more than 1929.

There should be a closer relation between the financial and the design, production and sales departments; this will, I think, assure a more steady production by taking into consideration the type of plane best suited to the job it is to do for the purchaser. I would say 50 per cent of the planes sold during 1929 were not right for the job, and did not operate economically; besides, the first cost was much higher than necessary.

Abundant free capital, ample commercial credit, growing export markets and the co-operation of state, municipal and national government forces in pushing forward expansion seem to promise an excellent maintenance of the labor and industrial markets of 1930, which will automatically reflect favorably on the aircraft industry and prevent the kind of trade recession that so frequently follows a financial collapse like that of 1929.

W. B. Kinner

In my opinion, aviation is passing through its first fair-sized readjustment since it grew to be a recognized industry, and a great many of the smaller units have already cancelled all plans for expansion. The other units which have been financed in 1929 for extensive construction are going forward with these plans, but perhaps on a somewhat more conservative basis. This is particularly so where men are using their personal fortunes.

Close co-operation between the manufacturer and distributor, both having ample reserve capital to tide them over the dull periods which always occur in any industry, will assure steady production, but sales will always be seasonal to some extent at least. Some think by developing our foreign markets the sales would be more steady. In my opinion we should develop our home territory to a point of greater production, making it possible to sell at more attractive prices before we enter the foreign fields. By building the small two- and three-place passenger planes with low horsepower, we not only supply

the school with an ideal plane for training students, which is economical to operate, but we also present the ideal plane to the sportsman who wishes to fly to his country estate, golf club or hunting lodge. These planes need only 75 to 100 hp., and the largest will fly fifteen miles on a gallon of gasoline.

I think the ideal plane for the American market is the combination open and closed model—at least in the small two-or-three place type. To sum it all up, there seems to have been sufficient capital invested in the industry to put it on a business basis. I think all that is needed now is faith in our product and the future of the industry, and in a very few years we will have an industry which will surprise the most optimistic of the pioneers.

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Priority to the Government Market—Plenty of Cash on Hand

By JOHN H. BAKER
President, Air Stocks, Inc.

THE GREAT BULK of the business done by the manufacturers in 1930 will be on government contracts, and with those transport lines whichc hold government contracts.

Commercial sales in 1930 should be expected to be considerably less than in 1929, as fewer new companies will be organized; the large amount of new equipment delivered in 1929 will scarcely have become obsolete, and the secondhand problem is increasingly with us.

Offsetting and favorable factors are the assurances of a great number of new airports and of an unfailing and increasing interest in learning to fly on the part of the younger generation.

From the manufacturers' standpoint I consider two problems paramount: (a) The use of lighter materials, resulting in more payload per horsepower; (b) Design reducing much further the risks of judgment in piloting. I see no likelihood of an extensive private buyer market until such goal is attained.

Transport companies will go after the package business. I have never understood why they did not do so prior to seeking passenger business. Night passenger service will have to be inaugurated.

Distribution, field service and accounting methods will be developed on a businesslike basis in 1930.

The prices at which most aviation securities are now selling will tend to prevent the entrance of new competitive interests, unless provided with government contracts. The industry as a whole is over-supplied with cash, and well-managed companies should not need more cash in 1930.

Emphasis in 1930 should be on laboratory research.

The outlook is much better than it was a year ago.

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More Speed and More Gliding—And Cheaper Engines

By J. D. ALEXANDER
President, Alexander Aircraft Co.

I FEEL RATHER HOPEFUL about the production and sale of airplanes and aerial transportation for 1930. The reduction in air transport rates will undoubtedly encourage many to travel who have not been in the air. This will create more confidence in aerial service.

Probably more airplanes will be sold and used in 1930 both for business and for pleasure, but they will be mostly of the cabin type and they will have to be able to cruise faster. The exception will be the slower open ships used for training.

As in the automobile business there is a constantly growing demand for more power and speed. Future motors must be larger and better streamlined. 1930 will see the beginning of disfavor for the radial type motor and the development of several in-line motors.

Many things will be done by designers to reduce drag, such as concealing landing gears, removing struts and generally cleaning up designs.

The glider movement will stimulate flight training. Many men who think themselves too old to learn to fly will be coaxed into gliders which they will fly with little trouble. They will then enroll as flying students and buy airplanes. Probably before the end of the year every flying school will have its glider department for kindergarten flight training.

Motor prices are entirely too high—too large a percentage of airplane cost. These prices will come down in 1930. Motor manufacturers will realize that it is a good business bet to spread their recovery of development costs over a larger period of time. We have proved that it is the proper thing to do regarding such costs on our airplanes.

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The Slump Will Prove a Blessing—The Fittest Will Survive

By GLENN D. ANGLE
Vice-president, Le Blond Aircraft Engine Corp.

THE "GOLD RUSH" in aviation during the preceeding months has been generally viewed with both amazement and alarm among those of us who have enjoyed ten or more lean years in the industry. Scarcely anyone today doubts the present or future possibilities of aircraft as a means of transportation, but substantial progress should be measured by engineering or associate development and not by the amount of capital invested. The recent slump may be considered most fortunate for the industry as a whole, since it has given us all an opportunity for retrospection.

We have seen new companies springing up almost daily and apparently finding little difficulty in interesting the necessary working capital. It seemed that about everyone who could build an airplane or an engine was organizing a company and planning immediate production. Those infant organizations, no doubt, entertained profound hopes that they would share heavily in this potential market, despite known difficulties and delays encountered by even the more experienced in matters of organization, finance, design, development and manufacturing, as well as in securing the required approved type certificates before sales could actually be made. A high mortality percentage among such organizations is unavoidable, and unfortunately results in creating a rather unfavorable reaction in the minds of the investor or prospective purchaser.

There will be new companies formed for the manufacture of aircraft and regardless of competition they will meet with success if their product is right and they

have the ability to market it. Of the several phases in the present state of the aircraft industry, the most vital of all seems to be a vast array of airplanes and engines, which the influx of capital and new companies has given us, of which so few are really ready to be marketed because of failure to solve one or more of the several problems enumerated above. Over-production of designs may be quite as serious as unsold products and even more wasteful of capital invested.

I believe that more airplanes will be manufactured and sold during 1930 than during the preceeding year, and I further believe that the major portion of this increase will be among the two- and three-place ships. I also believe that the majority of these ships will be powered with radial air-cooled engines and that the ardor of the in-line engine enthusiasts will have become noticeably dampened before the end of the year. The demand for a suitable inexpensive airplane for schools and private use was unfilled during 1929 and will be even greater this year.

Every manufacturer must study his own particular problem and be optimistic to the proper degree. It is believed that each one should, if possible, determine a normal production for the year and avoid any sudden changes in schedule regardless of demand. Aircraft products must be sold this year, and more attention will be given to proper selling methods than at any time previous. Conscientious manufacturing, honest and forceful advertising, prompt and efficient service, and ethical sales policies must be exercised by the companies which expect to survive. Now that the "Gold Rush" stage is over, it is time to critically regard the products and financial statistics with a view of determining which companies will withstand the competition that usually follows a boom. This evolution will eliminate all but the fittest.

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The Honeymoon Is Over— Prescription for Progress

By EDGAR N. GOTT
President, Keystone Aircraft Co.

AVIATION HAS HAD, in its comparatively brief history, two forced draft periods of development. The development during the War expanded manufacturing facilities far beyond what the public could absorb after the peace treaty was signed, and brought the design of airplanes to a very exacting science which unfortunately, at that time, was applicable only to military aircraft, as the present day commercial ship was then unthought of.

Edgar N. Gott

The last two years have shown a tremendous awakening of public interest, followed by the steady growth of sub-conscious confidence in flying which is, after all, the true foundation to the success of airplane development.

The momentary reaction in all lines of business will undoubtedly be a true blessing to the aeronautical industry. In the past years air lines have been laid out on a magnificent scale. Aircraft have been designed and constructed affording every element of comfort to the traveling public. The various companies have been proceeding along independent lines, each developing its own product in diverse ways. The several mergers of the past year will unify these lines of endeavor, and will tend to weld them into a coherent whole. Opportunity will now be given those in the industry to catch up with the designs and plans which they have evolved in the past two years, and to prove to the general public, which after all is the ultimate consumer, that their assumptions have been founded on fact.

The era of promotion has ended. We are now confronted with the age of hard work. Now that the appetizers have been consumed, we must apply ourselves to a simple meal.

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Prospects for $20,000 Amphibions For Ferry Service

By ALBERT PALMER LOENING
Vice-president, Keystone Aircraft Co.

THE NEW YEAR was scarcely born before we realized that there was a market for expensive airplanes if they were able to earn money. It was also gratifying to learn that there were still a few individuals left in the United States, who, despite the stock market crash, could afford the purchase of a high-priced airplane.

I feel that the sales trend for 1930 in regard to airplanes in the price class between fifteen and thirty thousand dollars, with which I am most familiar, will show a greater volume than in 1929. One phase of aviation that will cause this is the use of transport airplanes in short hauls at low prices. This is being done successfully now in two cities on the west coast—Seattle and San Francisco, and will without question spread to many other localities. This is an angle of the business that had until very recently been completely overlooked, and can be compared more to the joy-hopping business than straight air transport. However, it combines both features. It gives an individual a short airplane ride for a very small sum of money and yet takes him to a desired destination. The fare on the run between Seattle and Bremerton, an airplane distance of 15 miles, is $2.50 per passenger. On San Francisco Bay, three different routes are proposed. The fare here will also be $2.50 per trip. On the Seattle to Bremerton run 14,000 passengers were carried in three months at $2.50 per head. With such a volume of gross we can readily see that the initial cost of the airplane is not the paramount consideration, as that can be readily absorbed in the great volume of traffic resulting.

There are, of course, many advantages to a short run in comparison with a long-distance transport route. Permanent facilities are only needed at one end of the line. The traffic which makes the business, being local, is easily sought out and obtained so that we have a new form of short air transport which promises the greatest hope of expansion in the near future. The hauls that pay well invariably are across harbors or bays. This calls for an amphibion plane, and ramps at each end. In this way a plane can be speedily loaded and unloaded and then turned around.

I feel that in 1930 there will also be a market for airplanes in the fifteen- to thirty-thousand-dollar class by operating companies who will have their machines available for charter. As more and more people fly and become sold on the advantages of speedy air transporta-

tion they will consider chartering a machine long before they are ready to purchase and operate one themselves. Heretofore, I consider that the main deterrent to a big chartering business has been the lack or the crudeness of ground facilities, and the inaccessibility of these facilities to the centers of population. This is rapidly being overcome and I think that beginning in the spring of 1930 a very substantial chartering business will be started.

As regards the individual ownerships of expensive planes, I believe that this business has not been properly developed, not due to any lack of initiative in the airplane selling end, but chiefly due again to the lack of ground facilities necessary to inspire confidence. There are many men of wealth in this country who are potential purchasers of expensive airplanes but without a doubt there is fixed in their mind the present "hot dog" status of commercial aviation, namely, dusty, ill-kept flying fields with ramshackle, broken-down hangars and a general depressing atmosphere.

When some of our new fields are completed, in the spring of 1930, with modern, clean, substantial hangars, well-kept fields, and runways, I feel that a new class of purchasers will enter into the airplane world.

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Bringing the Public and Aviation Together

By C. S. "CASEY" JONES
President, Curtiss Wright Flying Service

THE SUCCESS of aviation as an industry depends in all probability from this time forward upon the quality of the merchandising which is employed to bring the public into the ranks of buying and repeating customers. Naturally, the quality of individual product and of the service to accompany it are both exceedingly important, but neither will be factors comparable, in gaging the rapidity of the industry's success in volume of business, to the rôle to be played by sound merchandising.

C. S. Jones

Not so very long ago, men and women were flying for the first time in heavier-than-air craft, and this constituted the period in the industry of invention and demonstration. With the succeeding wartime and post-war development commercially, engineering, construction and production held the center of the stage. Finally, after the pioneer flights in the past three or four years, promotion, financing and organization were completed.

Henceforth, the problem before the industry is primarily to sell aviation to the public. Design and construction must be maintained and improved constantly and the incentive which guarantees this is the promise of healthy competition. Service must be brought to a high state of perfection and, again, competition makes this assured. The final test of success will remain in the balance sheet of each company, with the credits and debits depending on sales.

Merchandising is now necessary to aviation: the most modern, vigorous and sound merchandising which it is possible to enlist. Therefore, the industry is on the lookout just at present for the most authoritative information on this subject, and market surveys will probably occupy the major portion of the industry's attention for some time to come. By the time this progress of merchandising achieves real effect, the public will be thoroughly air-minded and, in addition and which is better, air-active.

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Better Financing and More Aid to the Dealer

By H. N. WHITTELSEY
President, Whittelsey Manufacturing Co.

THE FOLLOWING pertains primarily to the open cockpit type of aircraft, which only has been undertaken by us and therefore studied. Reply is being made to your paragraphs by number, as follows:

1. The aircraft industry for 1930, in my opinion, will be on a much sounder basis than in 1929, after going through the fire of the lack of sales during the latter part of 1929 and the severe disruption of Wall Street. It is my opinion that in the long run this experience will have a very fortunate stabilizing effect. It will remove many dreams of easy money and bring everyone to the realization that after all the same sound business principles must be adhered to if success is to be obtained in aircraft, as in other lines of manufacture or sale.

2. From our study, we estimate that the total production for 1930 will approach the same figure as 1929 but this production will be more selective and more suitable to the market demand.

3. Little more can be done than has been done in the automobile industry in order to prevent unduly seasonable conditions and following this industry, the open type planes for the Spring and the closed type for the Fall, would be the natural centers of the drive.

4. In our opinion the industry does not need new markets. It has a potential market within the United States far beyond the most extravagant estimates of any sales manager. Few have learned how to sell airplanes to the potential market and the problem is so new that many new sales methods will have to be developed.

In the first place, marketing to the individual consumer who is the ultimate buyer (who must be ultimately sold in volume for stability), must be along financial lines laid down in this country for other commodities of like value. In other words, financing to the distributor or dealer and from the distributor or dealer to the consumer must be facilitated by the large finance companies, either of the old line, or those developed by some of the larger aviation units. This financing must be provided at a reasonable price, to include insurance. The distributor or dealer should not be required to tie up more capital in the handling of aircraft than would be necessary in the handling of automobiles, radio, washing machine, etc., in like volume. The consumer should be able to buy aircraft in the same convenient way that he purchases the several items named. A great deal still remains to be done in this matter and I believe 1930 will be the first year in which any reasonable plans will be effective.

Secondly, in the manufacture of aircraft we have substantially the first attempt to produce and sell to the public an article that cannot be shown in the showroom windows and in general be brought to the eyes. The general potential buying public only sees a plane once in a while at a field, usually roped off for safety, and

otherwise must depend on pictures in the Sunday papers for his familiarity with planes. These pictures for the most part are large planes and have no present use to him as an owner. It is well known in merchandising that a man may see a washing machine, radio, etc., in a window many, many times before he even has the urge to make inquiry in regard to it; and this inability of the general public to familiarize themselves with the plane at close hand will be one of the most difficult sales features to overcome, but one of the most important. Real volume largely depends upon it.

The distributor or dealer is very much like Robinson Crusoe. He has his own airport, but ordinarily has no facilities for bringing in feeders to his sales efforts, that is, the rank and file of the possible interested public. His contacts with the principal centers is very limited, and this is particularly the case with reference to contacts with those who are able to buy planes. These distributors and dealers must be shown the way to lay down proper feeders to sales.

5. We believe that the two-seater and three-seater are definite standard types that will always persist and be made and sold in volume. They may be considered as comparable to the roadster or five-passenger open car on one hand and the seven-passenger open car on the other. These planes must be the forerunner of the sales for the cabin planes. The new owner-pilot, after being taught about the airport, still must learn airmanship in the same sense that the sea-going man must learn seamanship. In the many years of seamanship no substitute or home study has taken the place of actually being responsible for a vessel at sea and this no doubt will apply in the case of aircraft in regard to airmanship.

In closing, it is my firm belief that the makers of open cockpit type planes will be much more sound and will actually make more money in 1930 than in 1929. Many finance plans will be in operation, some of which will work properly, and these plans will have a stabilizing effect and will produce a large increase in sales. I believe every manufacturer is seriously studying this general sales problem and the aids to the distributor or dealer will be much more than were provided in 1929, with the result that these sales organizations will make much better showing individually, and thus increase the volume from the manufacturer.

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Closer Adaptation of Types to Needs—More Seaplanes

By A. O. MEURER
Ass't Sales Manager, American Aeronautical Sales Corp.

THE COMING YEAR will see the bed-rock stabilization of the aircraft industry. The fittest will survive. We have seen many meaningless airplanes on the market, planes that were not serving a definite purpose, planes that did not have a marketable value. Experience has taught us what type planes are needed for student training, for private use and for air transportation lines. Only the manufacturers of planes that will fit these outlets can carry on.

Production is one of the most important items that must be watched with great caution. One cannot arrive at a definite figure as to how many of the planes of the type he manufactures are to be sold over a year's period, but a manufacturer can, through definite contract orders with his established outlets (dealers and distributors), get a conservative idea as to the number he must manufacture. Over-production has been, in the past, one of the greatest drawbacks to the advancement of the Aviation Industry. New markets must be created. We have all seen enough of this idea of selling each other. People who do not fly now must be reached and this can only be established through proper sales promotion setups to attract the market we are striving to reach.

It is my firm belief that in the coming year, we will see many more amphibions and flying boats being manufactured. It is true that we have made rapid advances in the construction and design of the landplane, but there has been an unreasonable neglect in the furtherance of design and construction of the amphibion and flying boat. People are waking up to the idea of using the many waterways in the United States as natural landing places.

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Stronger Companies and More Private Owners

By MINTON M. WARREN
President, Moth Aircraft Corporation

THE PRESENT SEASONAL depression combined with the stock market crash should be a great help to the aircraft industry in closing down many of the weak aircraft manufacturers who were organized more for selling stock than for selling planes, and whose output, sold at less than manufacturing cost, resulted in over-production and distress selling in the airplane market, with resultant loss to legitimate manufacturers.

M. M. Warren

With these companies out of the picture, it is possible that the stronger and well financed companies with good products may be able to sell in sufficient quantities to reduce airplane prices, or at least hold their present prices.

In spite of the distress selling and over-production, I believe that more airplanes will be sold and manufactured in 1930 than in 1929, due to the large increase in airports and student pilots and replacement demand, which should be particularly large in 1930 because of the supply of obsolete models and engines, which will be discarded.

The various aircraft financing companies, such as the Aviation Credit Corporation, will be more and more a factor in enabling small dealers to carry on hand one or two new planes, and in this way smooth out the production curve of the factories, which is now so seasonal.

We note an increasing demand from real private owners, with at least one-third of our planes going to private owners for strictly pleasure purposes.

The in-line engine is certainly becoming more popular, especially in light planes, and the two-seater is replacing the three-seater for student training and sport use.

Although open planes will always be popular for sport and training purposes, I believe that the long range tendency will be similar to the automobile, and be towards cabin or convertible types.

Other contributions to this symposium will appear in next week's issue.

THE *Aeronautic Industry* DURING 1

By
R. SIDNEY BOWEN, JR.
Associate Editor of AVIATION

Now that plans of endeavor during the new year are being made, it might be of considerable help to review the year that has recently passed into aeronautical history. The lessons taught by experience, no matter how indelibly stamped upon memory, are often overshadowed by the passing of time, and the prospects of future accomplishment. ¶*To review the past year in detail would require volumes. Yet, on the other hand, it is possible to review the important and outstanding features of the year. Particularly those that may have an effect upon the future of aeronautics in this country.* ¶*For that purpose we devote a section of this issue. The accompanying article deals with the industry as a whole during 1929, and the five other review articles are on the subjects of airport development, air transport, trend of design, aerial events, and aeronautical finance.*

THE YEAR OF 1929 might well be regarded as the pivot point in the history of American commercial aeronautics. There are, of course, those who may lift up their voices at such a statement and proclaim that the year of 1927 will never have an equal. That is quite true if one is to gage the growth of an industry by the amount of public attention that it receives. On the other hand, if the growth of an industry is to be gaged by the amount of public *patronage* that it receives, then the year of 1929 can truly be regarded as the pivot point in the history of commercial aviation in this country.

Public patronage is something which the aeronautic industry has not acquired as yet, at least, not to any really profitable degree. And public patronage 365 days out of every year is something which the industry must acquire if it is to continue to survive and progress. However, let it not be thought for a second that the much desired public patronage is not forthcoming. It is, and not just sometime in the dim future, either. In fact, we are optimistic enough to believe that it is just around the corner, and that we and not our grandchildren will witness that historic and aero heartcheering event. Therefore, let us not start hanging the crepe, but rather, review the aeronautical industry's changes and lessons of 1929 in order that we may obtain a clear picture of just where the industry stands today, and of what is ahead in the work of building up a steadily increasing amount of public patronage.

It is admitted that the famous flights of 1927 attracted the interest, keen and otherwise, of the general ublic. They constituted the "break" for which a struggling group of pioneers had been praying. But there is no need of recording in detail the outcome of the break. It is well known history that almost overnight a dream became a realization; that all sorts of aero enterprises sprang up throughout the country; that sales went sky high, and that carloads of money were poured into the aeronautic melting pot.

For almost two years the mad parade carried on, and then shortly after the beginning of 1929 it began to slow down. Sales began to drop; stock prices began to drop, and the spirits of a lot of aeronautical men began to drop, also. However, the dropping business was inevitable. Such unprecedented prosperity could not possibly continue in the face of so limited a market as existed at the time. And strange as it may sound, that market was the industry itself, and not the general public as many believed, or were led to believe.

In short, for two years the industry had been selling its products to itself and at the beginning of 1929 aero sales were right next door to the saturation point. It is quite probable that had production facilities been at that time what they are today, the sales slump in the industry would have come to pass much sooner. The beginning of 1928 saw the industry far behind on 1927 orders. The

1929

beginning of 1929 saw the industry behind on 1928 orders. But the beginning of 1930 does not find the industry far behind on 1929 orders. In fact it finds that there are from 700 to 1500 airplanes on its shelves.

Therefore, the year of 1929 can right be considered the pivot point in American commercial aviation, for it was in 1929 that overnight prosperity petered out, and the industry took steps to reorganize on a more business-like basis and proceed forward toward increasing sales volume, and not fluctuating quick sales volume in a limited market.

The Aviation Corporation

Alaskan Airways, Inc.
Colonial Airways Corp.
Embry-Riddle Aviation Corp.
Interstate Airlines, Inc.
Southern Air Transport, Inc.
Universal Aviation Corp.
Fairchild Aviation Corp.
Aviation Shares Corp.

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United Aircraft & Transport Corp.

Pratt & Whitney Aircraft Corp.
Boeing Airplane Co.
Boeing Air Transport
Pacific Air Transport
Chance Vought Corp.
The Hamilton Standard Propeller Corp.
Hamilton Metalplane Co.
Stearman Aircraft Co.
Sikorsky Aviation Corp.
Stout Air Services
Northrop Aviation Corp.
United Aircraft Exports, Inc.

Curtiss-Wright Corporation

Curtiss Aeroplane & Motor Co.
Curtiss Airports Corp.
Wright Aeronautical Corp.
Moth Aircraft Corp.
Keystone Aircraft Corp.
New York Air Terminals, Inc.
New York & Suburban Air Lines, Inc.
Travel Air Co.

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Detroit Aircraft Corporation

Aircraft Development Corp.
Ryan Aircraft Corp.
Aircraft Parts Co.
Gross Ile Airport, Inc.
Marine Aircraft Corp.
Blackburn Aircraft Corp.
Eastman Aircraft Corp.
Lockheed Aircraft Corp.
Parks Air College, Inc.
Gliders, Inc.
Detroit Aircraft Export Corp.

"The Big Four"—the four largest holding companies and their subsidiary companies

THE OLD SAYING, that . . . united we stand and divided, we fall . . . was more or less the theme song of the industry during 1929. The beginning of the year saw about five times too many manufacturers fighting for individual existence. And of that number, at least 80 per cent were endeavoring to make the market suit their product instead of making the product suit the market. The sales barometer soon showed the error of such ways, and rather than attempt the manufacture of several types of planes, various manufacturers and financial groups decided that there was both strength and profit in unity. As a result, mergers and consolidations took the aeronautic world by storm.

For accuracy's sake, it might be stated that the merger and consolidation fad had its real beginning in the last of 1928. In December of that year United Aircraft and Transport Corp. was formed. The stock, however, was not issued until after the first of 1929. The second group of the present time "Big Four" in aeronautics . . . The Aviation Corporation . . . was announced in March of 1929, and the third group . . . Detroit Aircraft Corporation . . . was formed in June. During all this time two prominent groups, the Curtiss-Keys group and the Wright-Hoyt group had been acquiring control, or partial interest, in a number of widely varied aero enterprises, and in July the two combined to form the Curtiss-Wright Corporation, the fourth and last of the Big Four.

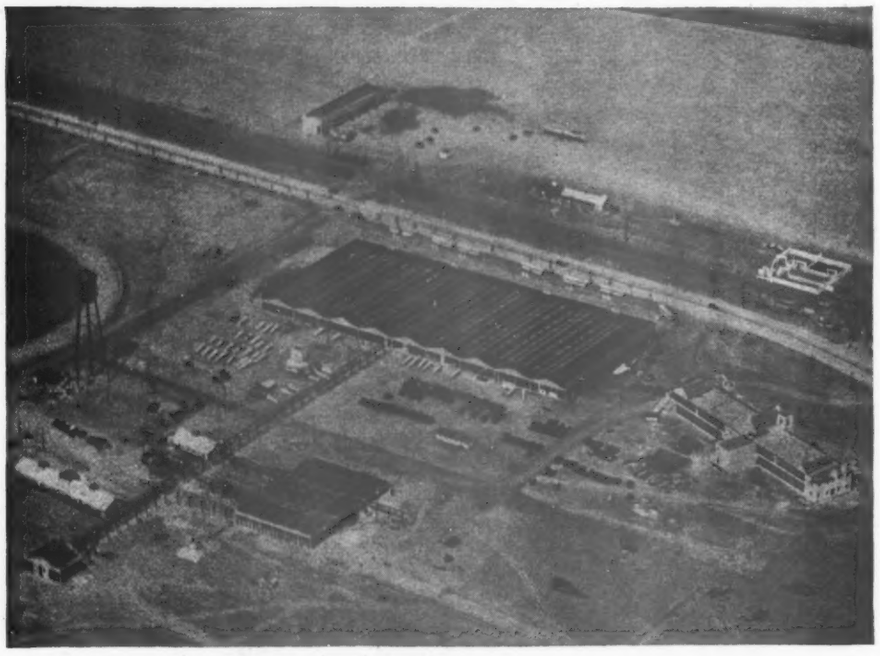
The Big Four having started the merger and consolidation fad, the smaller, but by no means less important, groups in the industry immediately started to follow suit, and for a period of months the organization picture of the industry was in the process of continual change. As has been mentioned, mergers and consolidations took the aeronautic world by storm, and regardless of the amount of benefit to be gained, aero companies merged and re-merged, and consolidated and re-consolidated until it was almost impossible to keep tabs on who was with who and what was with what, from one day to the next.

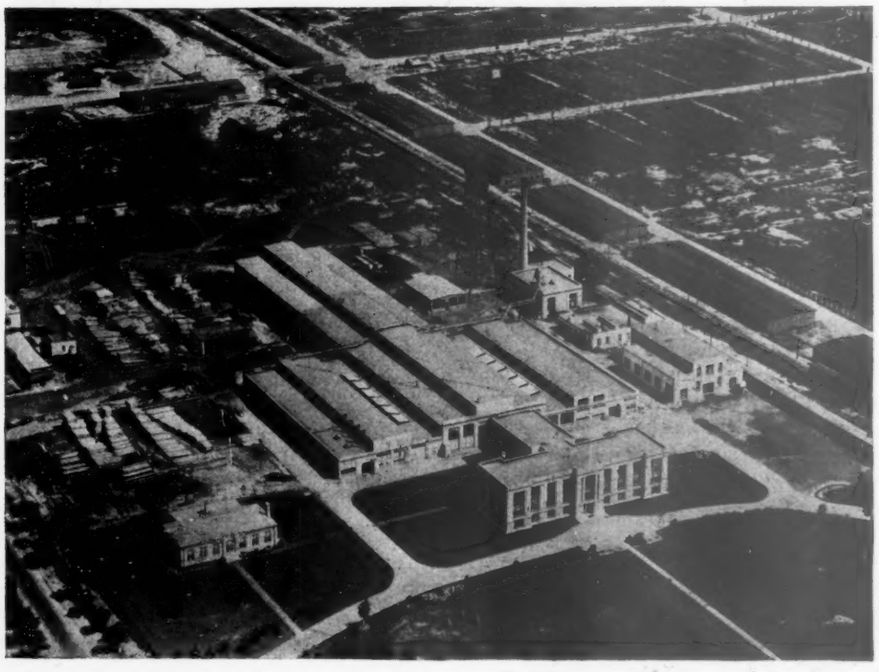
The benefits of the merger fad to the industry as a whole can not be fully estimated at this time, as there will undoubtedly be several more changes before the smoke clears. However, it can be taken for granted that the industry has progressed and will continue to progress as the result of 1929's mergers and consolidations. To begin with, the lives of several worthy though financially disabled companies were saved by the mergers. Had they been forced to carry on independently they would undoubtedly have sunk below the waves of red ink. As it is now, keen brains and ability have the opportunity to contribute unhampered to the future of aviation. A second benefit is that the majority of the money invested in aeronautics has been collected together in a few groups where it will undoubtedly bring forth the best results. A third benefit is that the mergers and consolidations brought the interest and money of allied industries into aeronautics. A fourth, and incidentally quite important benefit, is that the mergers and consolidations will gradually force most of the existing fly-by-night and gyp aero concerns to cease operations, due to the keenness of competition with well entrenched companies.

Let it not be believed, though, that the mergers and consolidations of 1929 were all perfect. In fact, they were far from it in many cases. One of the unsolved

mysteries in aeronautics today, is why some of the organizations merged with each other, or were brought together under the same holding company. We put it down to the hectic desire to merge and consolidate, regardless. In looking over the industry's line-up as it stands at present one finds many instances of where two, and sometimes three, direct competitors of each other are grouped together. It stands to reason that many of them are white elephants who come in with the tide, and it will be interesting to note how long they will last before being split up, or washed out of the picture entirely.

From the standpoint of production facilities, 1929 was the pivot year in American aeronautics. Up to about the beginning of that year manufacturers were working





Above: Looking down on the buildings of the Alexander Aircraft Company at Colorado Springs, Colo. Below: The Garden City, L. I., plant of the Curtiss Aeroplane and Motor Co., Inc.

day and night to boost production to a point where it could at least keep level with sales. To do that necessitated the construction of new plants or the enlarging on a big scale of old plants. In addition it necessitated the installation of more equipment, and, in many cases the hiring of more personnel. And in 1929 the supply-exceeding-demand point was reached. Today the airplane and engine factories are equipped to turn out far more planes and engines than the present market can absorb or has absorbed since Lindbergh's flight.

In keeping with the enlarging of production facilities, production methods and factory operation have been improved also. Better materials are now obtainable, better workmanship is being put into the products, and there is better material control in purchasing, in the store-room and in the shop stock-room. While the trend of design during 1929 is discussed elsewhere in this issue, as a matter of record it might be stated here that production in 1929 was not characterized by startling new features, but rather by a refinement of detail . . . the cleaning up of the 1928 product.

INCIDENTALLY, it takes but little thought to realize the good effect that the mergers and consolidations of 1929 had upon zero production in general. Several companies can now be of valuable assistance to each other, where before they were as ships that pass in the night. And perhaps of even greater importance is the opportunity for a more efficient and satisfactory adjustment of factory personnel. Undoubtedly it will be found that the employee overflow of one plant can be most advantageously used in another. And that fact, by the way, holds true regarding the executive as well as the time-clock puncher.

Aircraft operation also turned the corner in 1929. True, a number of passenger lines, and, of course, mail lines, were operating daily for some time prior to 1929. But it was during 1929 that passenger traffic in this country reached a figure comparable with that of air traffic in other countries. And it was in 1929 that def-

inite steps were taken to combine air travel with the older and more established means of transportation. Perhaps the biggest boost that air travel has received since its inception was the active interest that the railroads took in the airlines. And as history shows, that interest materialized during 1929.

HOWEVER, the year of 1929 proved that air transport in this country is still far from being conducted on a profitable basis. Traffic, while bigger and better than 1928, indicated that the American traveling public has still to become airminded. And that it is not inclined to become airminded until flying rates, in actual dollars and cents, are within the limits of the average traveler's pocketbook. It follows that it was the experience of 1929 that brought about the drastic cut in flying rates last month.

In short, from an air transport angle, the year of 1929 was encouraging, but it really did not come up to the hopes and expectations of airline operators, at least, from the standpoint of patronage by the general public. Of course, from the standpoint of new lines established and flying, airway and airport equipment installed, it was indeed a banner year. Perhaps some idea of the growth of American lines, domestic and foreign during 1929 can be obtained from the following:

Of the 54 domestic lines carrying passengers now established, 23 were inaugurated during the past year. Of the 7 foreign lines carrying passengers, 4 were inaugurated in 1929.

To sum up briefly, 1929 taught the air transport operator the same lesson that it taught the aircraft manufacturer . . . that a boom does not last forever, and that the time will eventually come when sales effort directed at a lukewarm market will have to be doubled and redoubled if future return from investment is to be assured.

The manufacturer tried to shove private flying down the American throat, and the operator tried to shove commercial flying down the same throat. The year of 1929 showed us that neither was particularly successful, and that progress henceforth should be made at a less hectic rate, and with the needs and desires of the customer uppermost in mind.

Above: A section of the Boeing Airplane Company factory at Seattle, Wash. Below: The newly constructed plant of the Wright Aeronautical Corporation at Paterson, N. J.

All of which brings us to the most important lesson that we learned during 1929 . . . the lesson that has to do with the marketing aircraft products.

As has been mentioned at the beginning of this article, from 1927 to 1929 aircraft sales were sailing sky high, but with the coming of 1929 came the realization that the industry was selling to a very limited market . . . a market that was the industry itself. And the result, of course, was that aircraft sales neared the saturation point, and that sales volume for 1929 fell far below expectations. So far below, in fact, that factory "shelves" are well stocked with 1929 production that must be disposed of first before the slate is clean for 1930 effort.

When sales first started to slump at the beginning of the year of 1929 (the slump was felt by some in the

Fall of 1928) stock market prices began to slump also, and when the Wall Street affair struck the front pages of the daily press a lot of aero dream-castles went up the flue. It is quite probable however, that regardless of the Wall Street panic, the aeronautic failures would have taken place anyway. Supply far exceeded demand, and there was not nearly enough business to go round. Particularly so in view of the fact that the industry was greatly overexpanded.

What then was a fitting remedy of the existing ailment? The slump was some help, for although it was unfortunate for those concerned, it removed some of the firms from the field. The mergers and consolidations were also a help, for they combined individual efforts. But the greatest remedy of all, and one that has still to show its real benefit, was the realization on the part of the industry that new markets must be developed, and the unanimous determination on the part of the industry to stop kidding itself that a general public market is being sold, and go after the new markets . . . markets outside of the industry itself. But, of course, to continue exploiting and serving the market that existed.

An air view of the new factory of the Travel Air Manufacturing Company, located at Wichita, Kan.

Just what market is the best is a subject that is at present cause for much speculation and argument. There are those who believe that small plane sales to the public at large will be the future backbone of the aeronautic industry. In other words, similar to the pleasure car in the automotive industry. On the other hand, there are those, too, who declare that aviation is a commercial transportation industry and that the small plane, or pleasure plane, will only be to the industry at large what the motor boat is to the shipping industry.

We take no sides in such a controversy at this time, and merely reiterate that the development of either market is dependent upon the reaction of persons and companies not engaged in aeronautics. That fact was the high point in the merchandizing lesson of 1929. And that fact will be the keystone of effort and progress by the industry in 1930.

AT THE PRESENT TIME there is little if any market research work being done in the aircraft industry. The experience of 1929 will soon bring that to pass, however. The year of 1930 will be witness to a widespread reorganization of the "smooth" sailing sales organizations that went to pieces on the market rocks of 1929. In short, aircraft merchandising is a subject about which very little is known at the present time, but which will receive concentrated attention from now on.

There is a tremendous amount of work to be done before the aero industry can boast of any really profitable degree of public patronage. Part of the task was accomplished in 1929. One item was the sinking in of the realization that outside markets must be cultivated and developed. Another item was the mergers and consolidations to better serve and service the new markets as well as the old. Still another was the development work of the airlines in the matter of passenger convenience and comfort. Incidentally, air transport will always be an important factor in aircraft sales volume . . . no one, to our knowledge, ever purchased an airplane before he had flown one. The fourth item was the high degree of production efficiency attained during 1929. The industry need have no fear for some time to come of losing a sale through the lack of a product.

We repeat, however, that much work remains to be done. The public has yet to be sold in quantity. And that task is one which will take time to accomplish, and we need not be disappointed to see sales for 1930 fall below the 1929 mark. Fall below they probably will in total number, but, on the other hand, they may exceed the 1929 mark in total value, due to the steadily increasing amount of commercial transport work being done.

But regardless of the long hard pull that is ahead of us, there is no need to fear the outcome. As a matter of fact, after the changes and lessons of 1929 the industry is in a better position for future effort than it ever has been before. In addition to past experience, which can always be regarded as an asset, it possesses a capital investment of around four hundred millions of dollars, fifty-six per cent of which is available within twenty-four hours for expenditure on future development and progress.

Flights OF *1929*

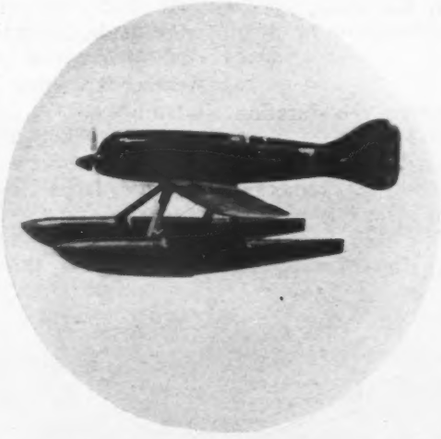
Showing a Tendency Toward the Sound Improvement of Air Travel

By JOHN T. NEVILL
Detroit Editor of Aviation
and ADAM LONG

REVIEWING the achievements of the aeronautical world, it becomes forcefully apparent that no previous year has been so productive of world's records and notable flights tending toward the sound development and improvement of air travel for the general public.

An outstanding feature of the year's performances is the success of commercial manufacturers in accomplishing tasks calling for large expenditure and elaborate organization facilities. Until 1928, when, as a result of Colonel Charles A. Lindbergh's still unsurpassed feat, civil aviation found itself possessed of ample capital, such development had been left largely to the Army and Navy. It was in 1929 that the financing provided during the previous year was effectively guided toward producing constructive results.

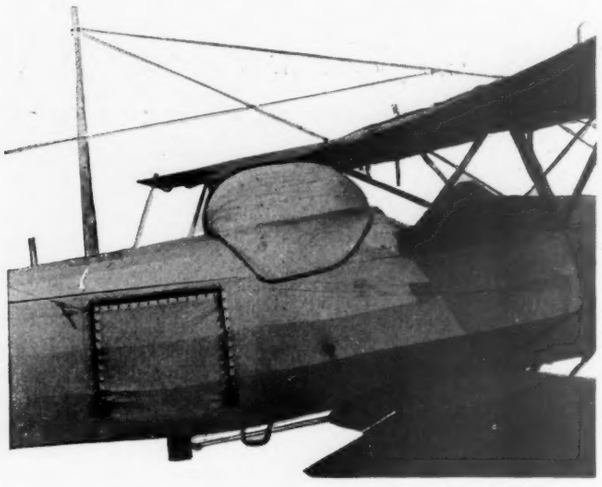
From the standpoint of the air traveler the year 1929 saw the world cirmumnavigated by the dirigible Graf Zeppelin in 21 days, 7 hours and 34 minutes, with but three stops and with 61 persons, 19 of them passengers, on board, the first world flight since the Army's airplane expedition of 1924. Captain Hugo Eckener encountered none of the tremendous handicaps which the Army surmounted, and his flight was in truth a commercial voyage rather than an adventure of hardship.



Above: A Fiat powered Macchi; an Italian entry in the 1929 Schneider Race.
Below: When the Air Tour came to town.

Still taking the view of the air traveler, engine and airplane endurance was demonstrated in a sensational manner by the flight of Forest O'Brine and Dale Jackson in the St. Louis Robin, which remained aloft over St. Louis and vicinity in July for 420 hours, 21 minutes and 30 seconds, and was ordered down, while still able to continue, when it was decided that the objects of the test had been accom-

plished. The practicability of refueling in the air had first been demonstrated by the Army at the very outset of 1929, when the "Question Mark," with its three engines and crew of five, under the command of Major Carl Spatz, remained in the air for 150 hours, 41 minutes and 15 seconds, exceeding even the duration record for lighter-than-air craft.



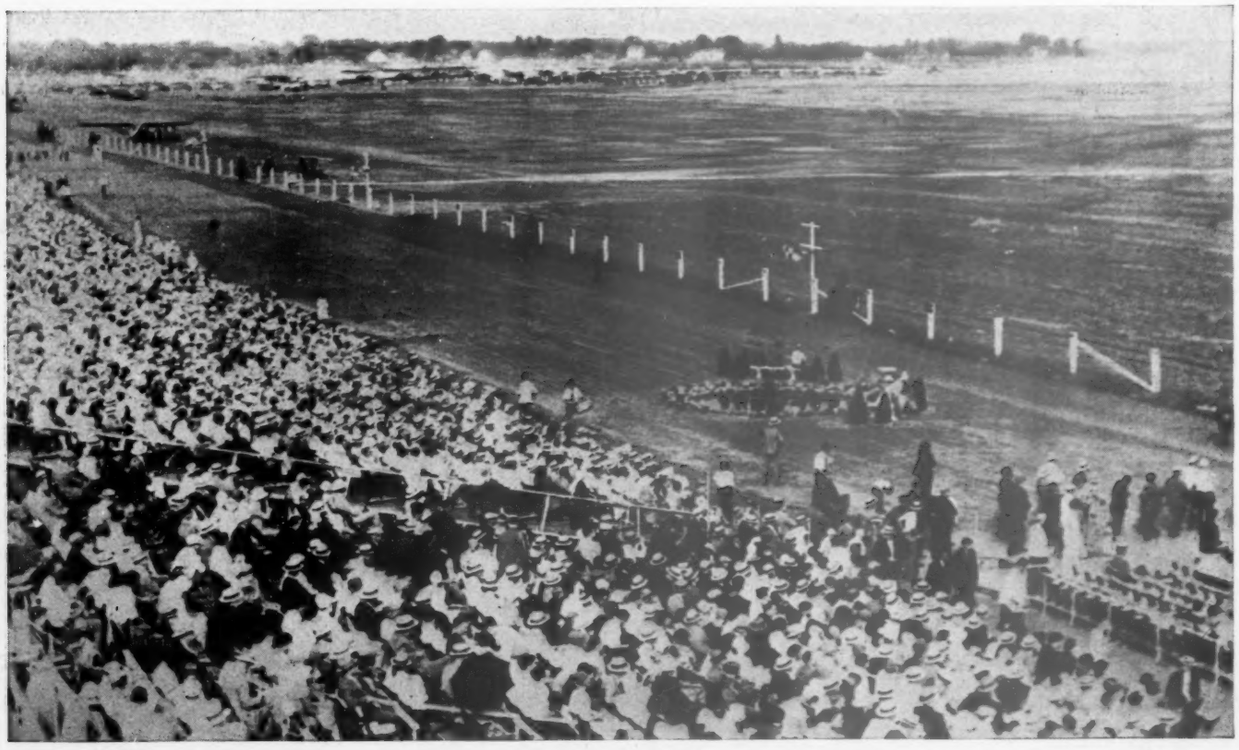
Puzzle—find the pilot. From under this watermelon shaped structure Lieutenant Doolittle took off, flew about, and landed his plane, entirely by instruments.

Another notable factor in the year's developments was the Daniel Guggenheim Fund for the Promotion of Aeronautics, which was discontinued at the end of 1929 with the announcement that its work had been completed. Under the auspices of the Fund, Lieutenant James H. Doolittle, Army pilot, culminated a series of blind flying experiments by landing a plane entirely by instruments while seated in an enclosed blind cockpit, thus scoring a definite victory in aviation's war against one of its most persistent enemies—fog. The Fund also found, in the Curtiss Tanager, the winner of its Safe Aircraft Competition. When the rules of that contest, for prizes aggregating $150,000, were announced in 1927, several designers and manufacturers freely declared that the plane called for would be safe because it never would leave the ground.

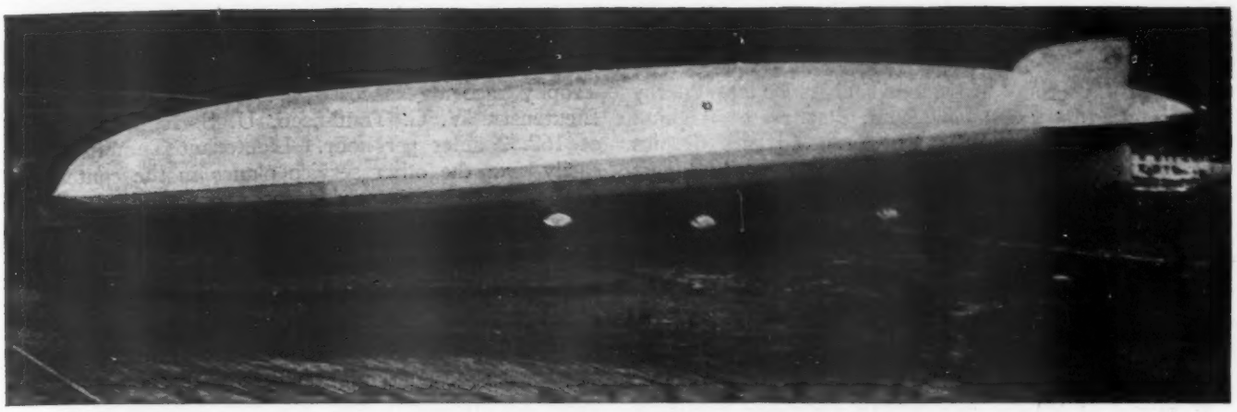
Since the air traveler is quite pardonably interested in getting back to his starting point, no reviewer can overlook the significance of the flight from New York to Los Angeles and return in 36 hours, 49 minutes and 48 seconds of actual flying time, made by Captain Frank Hawks, who earlier in the year had clipped the West-East transcontinental record held by Art Goebel.

This performance increases in importance when the comparative rarity of two-way record flights and the wind conditions favoring West-East flights are considered. The idea of refueling in the air was applied to a two-way non-stop flight by Nick Mamer and Art Walker, who flew the "Spokane Sun God" from Spokane to New York and return.

In 1929, only three non-stop trans-Atlantic flights were made, indicating that the popularity of sensational dashes across a watery surface beset by treacherous weather is waning in favor of sound experimenting over terra-firma. Of these three flights, the most noteworthy was the 4,200 mile non-stop journey of Captains Ignacio Jimenez and Francisco Iglesias over the South Atlantic from Seville, Spain, to Bahia, Brazil, in a plane bearing the impressive name of "Jesus del Gran Poder" (Jesus the All Powerful). The original destination of this, the sixth crossing of the South Atlantic,



The opening of the 1929 National Air Races at Cleveland.



Welcoming the Graf Zeppelin at Lakehurst.

had been Rio de Janiero, but exhausted fuel forced the flyers down.

Two crossings of the North Atlantic were negotiated, both from the United States to Europe. These, made by Jean Assolant, Rene Lefevre and Armento Lotti, Jr., in the "Yellow Bird," and Roger Q. Williams and Lewis A. Yancey in the "Pathfinder," added little to what had been learned from previous trans-Atlantic flights, although both planes landed in Spain, a country not hitherto visited by airmen flying directly from the United States. The "Pathfinder" continued to Italy, another nation which until then had not been favored with an aerial good will ambassador from this country.

Frank M. Hawks (in the cockpit) and Capt. Ray Collins, manager of the 1929 Air Tour, beside Hawks' transcontinental record breaking Lockheed Air Express.

GERMANY, with government subsidies being steadily reduced, contributed to transport development by completing the Dornier DO-X flying boat, which successfully made a 100 mile flight with 169 passengers on board. A German, Lieutenant Dinor, of Koenigsburg, set a new endurance record for gliders by remaining aloft for 14 hours and 44 minutes, and one of his fellow countrymen, Willy Neunhofer, broke the world's altitude record for airplanes.

Neunhofer's mark of 41,795 feet was only 2,655 feet greater than that of Lieutenant Apollo Soucek, U. S. N., who ascended to 39,140 feet in a land plane, and later, in the same ship, equipped with pontoons, set a new seaplane altitude record of 38,555 feet, which is as yet unbroken.

New standards in speed, as well as altitude, were established in 1929. Squadron Leader A. H. Orlebar, of the British Schneider Cup team, attained an official average speed of 357.7 miles per hour in a special trial after the Schneider cup race, which was won by Flying Officer Henry R. D. Waghorn with a speed of 328.64 miles per hour. To date, Squadron Leader Orlebar has traveled faster than any other human being.

Of importance to the progress of aviation, although scarcely of interest to the present-day airpassenger, was the successful flight of Rear Admiral (then Commander) Richard E. Byrd and his companions over the South Pole, which, coupled with the Commander's North Pole flight of 1926, completed the conquest of both poles by airplane.

Among the non-spectacular but highly constructive accomplishments of the year was a flight of almost 700 miles, from Detroit to Langley Field, Va., in an airplane powered with a Diesel engine. During this flight, which lasted 6 hours and 50 minutes, the engine burned only $4.68 worth of coarse fuel oil. It has been estimated that a similar flight with a gasoline engine of like power would have cost approximately $24 for fuel alone.

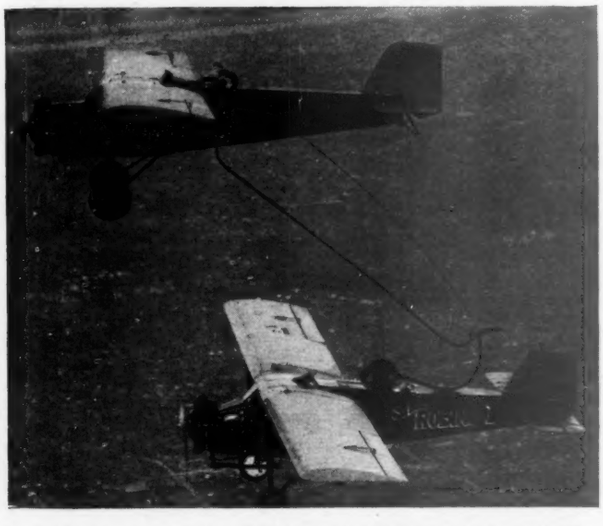
The national Air Races of 1929 held at Cleveland, O., were an index to the growth of aeronautics in general and of civil aviation in particular during the year. More successful than any such races in the past, they set a new attendance record; attracted unprecedented public attention throughout the country, and introduced a number of features new to this annual event, perhaps the most outstanding being the part played by civil aircraft in entertaining the crowds. The Waco and other acrobatic teams shared interest with the military and naval acrobatic groups, the latter including Colonel Lindbergh, flying as guest leader of the "Navy High Hats"; and the Travelair "Mystery Bullet," a commercial product, thrilled spectators by its maneuvers and speed. The "Mystery Bullet" confirmed earlier impressions of its fleetness by winning the free-for-all race, open to any type of craft, with a speed of 194

miles per hour, defeating the fastest military ships on the field.

The 1929 races also marked the debut of women in the national classic. A women's cross country derby from Santa Monica to Cleveland, the first of its kind ever held, was among the nine long distance derbies which preceded the opening of the races on August 24th, and women's events were listed among the 35 closed course races on the program.

These races also presented a wide variety of novelties which proved interesting to those engaged in the aeronautical industry as well as to the public. An airplane was successfully "picked up" and launched again by the U. S. Navy Dirigible Los Angeles, and a passenger was transferred from a dirigible to an airplane for the first time in history. The Cierva Autogyro flown by its inventor, demonstrated on frequent flights its ability to land without rolling forward; Charles (Speed) Holman performed loops and other acrobatics, including long upside down flights, in a tri-motored Ford, and the Navy's new all-metal dirigible made its appearance.

The national airraces and their accompanying National Aeronautical Exposition, which came to an end on September 2, were followed by the Fifth National Air Tour, which, starting from Detroit on October 5 and covering 5,017 miles, proved to be the most complete mobile exposition of civil aircraft ever held. Planes of every size and type were represented, from tiny open cockpit sport ships to huge cabin transports. Two open cockpit planes, both Wacos, finished in first and second places, and the largest of the transports, a tri-motored



For 17½ days they did it. O'Brine and Jackson taking on supplies.

Ford and the Curtiss Condor, finished third and fourth. Twenty-nine competing planes and ten accompanying ships started in the tour, and 24 of the competitors finished. All ten accompanying planes and one plane which was withdrawn from the contest but joined the accompanying flotilla, completed the tour. In several mishaps which prevented planes and pilots from continuing, no one was hurt. Three women started in the tour, and two finished.

The tour itinerary included twenty states and two Canadian provinces, and from the Canadian border extended as far South as Jacksonville, Fla., touching a number of East Coast cities. The western limit was Wichita, Kansas, home port of several of the entries.

Among the important annual events of the year which produced a world's record was the Curtiss Marine Trophy race at Anacostia, D. C., which was won by Lieutenant W. G. Tomlinson, U. S. N. with a speed of 162.52 miles per hour. Lieutenant Tomlinson won easily over the other service planes in the contest and established a new speed record for standard military seaplanes.

Preceding the trans-Atlantic flights of 1929 was another international flight in another direction, that of George W. Haldeman, who flew non-stop from Canada to Cuba in 12 hours and 56 minutes. It was the first non-stop flight between Canada and the Pearl of the Antilles, although not the first non-stop flight aross the northern and southern boundaries of the United States.

MORE THAN a score of records of various kinds, including marks for speed and altitude with pay loads and for planes in certain limited classes, were made in 1929. Some were broken, and some show indications of standing for some time to come. Shortly after the "Question Mark" had shown what refueling in the air could accomplish, for example, a number of assaults were made upon the Army's record and several startling but short lived marks were set up. Robbins and Kelly increased the duration record from 150 hours to 172 hours; Newcomb and Mitchell brought it to 175 hours, and they were still literally resting from this effort when Mendell and Reinhart, the "tough hombres" of Fort Worth, stayed up for 246 hours and 44 minutes. This was in July, and before the month ended, O'Brine and Jackson were aloft on the flight which settled the refueling endurance question for what seems to be an appreciable length of time. They lived in their airplane for more than 17 days, and traveled a distance estimated to more than equal a circuit of the world at the equator.

In the field of women's records, competition likewise was keen. During the year the number of licensed women pilots more than trebled, and women finally won from the National Aeronautical Association, as United States representative of the Federation Aeronautique Internationale, recognition of a women's classification for record purposes. Miss Evelyn (Bobbie) Trout, Mrs. Louise McPhetridge Thaden, winner of the National Women's Air Derby, and Miss Elinor Smith, in the order named, established solo endurance records for their sex, only to be beaten by Mlle. Maryse Bastie, of France, whose present record is 26 hours and 46 minutes. The late Miss Marvel Crosson is credited with the present women's altitude record, her mark of 23,996 feet exceeding previous figures set up by Mrs. Thaden, and before Mrs. Thaden, Lady Heath. Miss Amelia Earhart established a women's speed record of 184 miles per hour.

One of the last records to fall, toward the close of last year, was the long distance mark, as though 1929 sought to celebrate, before passing into oblivion, the 26th anniversary of man's first sustained power driven flight. Captain Dieudonne Costes and Paul Godos, flying over a measured triangular course at Istres, France, covered 4,984.8 miles, in 52½ hours, eclipsing the distance mark made by Clarence Chamberlin on his flight to Germany. Compare their distance with the 120 feet covered by Orville Wright exactly 26 short years before!

Aircraft Finance

DURING 1929

A Review of Conditions and Developments of Last Year Which Indicates that the Aircraft Industry Today Is in a Relatively Strong Financial Position

By K. Reid Campbell
Standard Statistics Co., Inc.

CURRENTLY there is a distinct air of pessimism noted in aeronautical circles. A funereal attitude seems to have spread through all ranks of the industry. What is it all about anyway?

It might be well to start off by recording what achievement areonautics chalked up last year. According to the compilations of the Aeronautical Chamber of Commerce, airplanes and engines produced in the United States in 1929 had a valuation of $98,000,000. Ninety-six major aircraft manufacturers produced 6,034 planes which, without engines, had a retail value of $44,457,000. Expressed in dollar value, the commercial output for the period showed a gain of no less than 96 per cent over 1928 results. In the engine division, equally impressive forward strides are chronicled. Engine outputs for 1929 aggregated 7,378 units, of which 5,517 were for the commercial market. The commercial market product had a worth of $17,895,300 and the military $8,600,-530. Commercial outputs were 100 per cent above 1928, and military takings 32 per cent ahead of the preceding comparable period.

Any other industry on the face of the earth that could point back to as impressive a record as that would assuredly be proud of the achievement, and justly so.

Getting down to brass tacks, the fact of the matter is that the unusual growth of aviation, in the past year especially, is precisely what accounts for its present predicament, paradoxical as it seems. One need only review the situation, however, to prove the case.

The pace set by the industry, hot as it has been, does not even compare with the expansion in the ranks of the trade, so that current production facilities are far in excess of requirements. Although gross returns on airplanes and engines for the year 1929 totaled $98,000,-000, the evaluation put on the shares of those manufacturing companies at their peak was in excess of $1,000,000,000. Thus, gross receipts were less than one per cent to the market values of these shares, and the net so infinitesimal that patently sizable losses are shown on the majority of books.

FOLLOWING Lindbergh's flight everyone desired to share in the profits indicated from the new, fast and efficient mode of transport. Time, the essence of business, had been conquered to a degree unthought of a few years ago. There was nothing wrong with this psychology; indeed, it can be prophesied that the future years will prove its correctness, but it was madness to expect that companies could be put together faster than airplanes and that all should prosper.

The year of 1928 saw the commencement of wholesale formation of new aviation companies. Some of these concerns were sound, some mediocre, many unsound and quite a few were inspired more with the idea of selling stock certificates than furthering the growth of an important development. Irrespective of potentialities, nevertheless, share values shot upward as the public scrambled to buy any certificate that had the magic word aviation or any synonym thereof inscribed on its face.

Through 1929, the movement continued. Delaware did a land office business in granting charters. By December, 1929, the Government reported more than 200 individuals, groups or corporations in the United States claiming to manufacture aircraft. "Obviously too many, when it is considered that approximately 50 automobile manufacturers are able to supply the nation's demand for some three or four million passenger cars per year," comments the report. The same sort of situation applied in the engine manufacturing division, in fact in every branch of the industry.

The point therefore, that now requires contemplating

A Tabulation of Aircraft Stocks Showing Their Fluctuation and Final Decline in Market Value During the Year of 1929

	February 15, 1929			May 24, 1929			August 23, 1929			November 29, 1929		
	Shares Outstanding	Market Price	Market Valuation	Shares Outstanding	Market Price	Market Valuation	Shares Outstanding	Market Price	Market Valuation	Shares Outstanding	Market Price	Market Valuation
*Aeromarine Klemm	126,000	10	$1,260,000	126,000	7	$882,000	228,100	4	$912,400	242,000	1	$242,000
*Alexander Industries	300,000	15	4,500,000	304,617	9	2,741,553	300,000	10	3,000,000	304,617	2½	761,543
*Allied Aviation Industries	.....	...	.....	.....	...	.....	110,000	13	1,430,000	110,000	2½	275,000
*American Eagle	200,000	15	3,000,000	200,000	12	2,400,000	600,000	5	1,200,000	600,000	1½	900,000
Aviation Corp. (Del.)	.....	...	.....	2,000,000	20	40,000,000	3,164,765	18	56,965,770	3,238,390	7	22,668,730
*Aviation Corp. of America	223,400	54	12,063,600	261,383	64	16,728,512	398,174	61	24,288,614	398,174	20	7,963,480
*Bellanca Aircraft	175,000	16	2,800,000	175,000	21	3,675,000	175,000	20	3,500,000	175,000	6½	1,137,500
Berliner-Joyce	.....	...	.....	40,000	27	1,080,000	40,000	23	920,000	40,000	20	800,000
Brunner-Winkle	.....	...	.....	.....	...	.....	70,000	6	420,000	70,000	5	350,000
*Cessna Aircraft	27,500	19	522,500	27,500	29	797,500	27,500	22	605,000	27,500	12	330,000
Consolidated Aircraft	.....	...	.....	550,000	39	21,450,000	550,000	34	18,700,000	500,000	14	7,700,000
Curtiss Aero and Motor Co	348,896	156	54,427,776	348,985	150	52,347,750	(a)	...	(a)	(a)	...	(a)
Curtiss Aero Export	75,000	46	3,450,000	81,775	40	3,271,000	(a)	...	(a)	(a)	...	(a)
Curtiss Flying Service	750,000	23	17,250,000	800,000	24	19,200,000	(a)	...	(a)	(a)	...	(a)
Curtiss Caproni	400,000	15	6,000,000	400,000	12	4,800,000	(a)	...	(a)	(a)	...	(a)
Curtiss-Reid	100,000	32	3,200,000	100,000	32	3,200,000	100,000	17	1,700,000	100,000	14	1,400,000
Curtiss-Robertson	*30,000	60	1,800,000	30,000	60	1,800,000	(a)	...	(a)	(a)	...	(a)
*Curtiss-Wright	.....	...	.....	.....	...	.....	2,000,000 (a) / 10,000,000 (b)	30 / 11	60,000,000 / 110,000,000	2,000,000 (a) / 10,000,000 (b)	18 / 7	36,000,000 / 70,000,000
Detroit Aircraft	.....	...	.....	.....	...	.....	887,769	17	15,092,073	1,031,655	7	7,221,585
Dayton Airplane Engine	.....	...	.....	40,000	19	760,000	40,000	37	1,480,000	100,000	6¼	625,000
*Douglas Aircraft	300,000	26	7,800,000	300,000	40	12,000,000	345,000	37	12,765,000	345,000	16	5,520,000
Fairchild	305,304	32	9,769,728	530,000	21	11,130,000	(b)	...	(b)	(b)	...	(b)
*Fokker Aircraft	510,000	24	12,240,000	1,000,000	56	56,000,000	1,000,000	67	67,000,000	1,000,000	18	18,000,000
Great Lakes Aircraft	.....	...	.....	200,000	24	4,800,000	200,000	21	4,200,000	200,000	7	1,400,000
Kinner Airplane Motor	.....	...	.....	.....	...	.....	2,100,000	2	4,200,000	2,100,000	1	2,100,000
Keystone Aircraft	240,000	45	10,800,000	287,572	34	9,777,448	(a)	...	(a)	(a)	...	(a)
Lincoln Aircraft	.....	...	.....	112,500	15	1,687,500	112,500	8	900,000	112,500	4	450,000
Lockheed Aircraft	138,000	16	2,208,000	138,250	22	3,041,500	138,250	11	1,520,750	(e)	...	(e)
Maddux Air Lines	265,020	12½	3,312,750	265,020	14	3,710,280	(c)	...	(c)	(c)	...	(c)
Mohawk Aircraft	.....	...	.....	.....	...	.....	10,620	13	138,060	.....	...	.....
Mahoney-Ryan Aircraft	100,000	21	2,100,000	.....	No data	.....	(e)	...	(e)	(e)	...	(e)
Moth Aircraft	30,000 (a) / 65,000 (b)	20	†1,000,000	30,000 (a) / 65,000 (b)	21	1,100,000	30,000 (a) / 65,000 (b)	26	1,600,000	(a)	...	(a)
*National Air Transport	30,000	460	13,800,000	650,000	43	27,950,000	650,000	39	25,350,000	650,000	13	8,450,000
New Standard Aircraft	.....	...	.....	40,000	15	600,000	40,000	17	680,000	40,000	17	680,000
Sikorsky Aviation	200,000	41	8,200,000	200,000	44	8,800,000	(d)	...	(d)	(d)	...	(d)
*Stinson Aircraft	123,905	20	2,478,100	123,905	19	2,354,195	123,905	18	2,230,290	123,905	16	1,982,480
Southern Air Transport	.....	...	.....	300,000	20	6,000,000	300,000	10	3,000,000	(b)	...	(b)
*Swallow Airplane	49,000	10	490,000	49,000	13	637,000	49,000	10	490,000	49,000	6	294,000
*Transcontinental Air Transport	500,000	25	12,500,000	525,000	28	14,700,000	525,000	24	12,600,000	525,000	10	5,250,000
Travel-Air	100,800	58	5,846,400	100,800	55	5,544,000	(a)	...	(a)	(a)	...	(a)
*United Aircraft and Transport	‡1,500,000	98	147,000,000	1,557,226	120	186,867,120	1,557,308	136	211,793,888	1,694,846	40	67,793,840
United States Air Transport	100,000	14	1,400,000	120,000	13	1,560,000	120,000	13	1,560,000	(f)	...	(f)
Universal Aviation	321,564	25	8,039,100	390,000	19	7,410,000	(b)	...	(b)	(b)	...	(b)
*Warner Aircraft	350,000	21	7,350,000	350,000	30	10,500,000	400,000	27	10,800,000	400,000	4	1,600,000
Whitteesey Mfg	.....	...	.....	.....	...	.....	240,000	12	2,880,000	240,000	6	1,440,000
Wright Aeronautical	300,000	270	81,000,000	600,000	120	72,000,000	(a)	...	(a)	(a)	...	(a)
Totals			$447,608,000			$623,302,000			$567,112,000			$274,640,000
Totals, including only companies for which records exist for all four periods (marked * above)			418,091,000			563,788,000			551,265,000			227,900,000

(a) Now integral units in Curtiss-Wright Corp. (b) Control acquired by Aviation Corp. (c) Control acquired by T.A.T. (d) Acquired by United Aircraft and Transport. (e) Absorbed by Detroit Aircraft. (f) Absorbed by Federal Aviation. †Estimated. ‡Ahead of which stood $12,000,000 pfd. 6% ($50) par.

Total valuations for groups of units which had, by Nov. 29, been brought together in leading mergers or holding companies:

Curtiss-Wright	$181,574,000§	$168,840,000§	$171,600,000	$106,000,000
United Aircraft	155,200,000	195,667,000	211,794,000	67,794,000
Aviation Corp. (Del.)	.....	64,540,000	59,966,000	22,669,000

Detroit Aircraft Corp. cannot be included, owing to lack of information about market values of several of its units before the formation of the merger.

§Plus Curtiss Airports.

is, has the money put into the respective companies so formed, dissipated into thin air?

Without doubt much of the capital invested in aeronautical enterprise has been irrevocably lost. The industry became overcrowded, competition in the limited market became too keen, and profit margins were shaved to the irreducible minimum. Finally some companies unaware of actual operating costs no doubt have been disposing of products at a loss.

That is but one side of the picture, however. The evidence at hand shows that the more conservative element commenced to take heed when they saw the extraordinary influx of capital to the industry as reorganizations and new stock issues resulted in the public absorbing millions of dollars worth of aeronautical securities over a period of but a few months.

Substantiating the above assertion it is only necessary to take two or three typical examples. Bellanca, for instance, in November, 1928, had its capital increased from 20,000 shares to 500,000 shares of which 126,500 were then offered at $23.50 per share. With this capital structure the company reported gross sales of $265,281 in the first half of 1929 disclosing its slow rate of operation. At the same time its balance sheet listed "Cash and Money on Call Loan $1,118,312." The only deduction here is that resources were being conserved in liquid form, evidently so that after the normal readjustment, and the weeding out of the hastily formed unnecessary companies, Bellanca would remain in a position to make its bid for fame.

ANOTHER EXAMPLE of conservation of a large amount of cash is shown in the case of the Aviation Corporation. This unit while really a holding company, to all intents and purposes, was formed with the idea of acquiring control of a number of independent concerns engaged in various phases of aviation and supplying capital when as and if needed by likely enterprises.

Commencing with $35,000,000 raised through the sale of stock in the early part of 1929 it reported $21,551,630 held in cash and call loans as of August 31, last. And so on through quite a few of the concerns extant.

This money, obviously, has not as yet been applied to the furtherance of aviation in any mannner whatsoever. Therefore to include it as "invested capital" as related to aeronautics and place alongside the actual returns of the industry in dollars and cents is an entirely unfair proposition. Patently there is no connection direct or indirect between the call money market and the aviation industry. The cash that has been retained in this manner is nothing more nor less than a very tangible backlog for the industry to fall back upon when such needs arrive.

All of which does not disprove the fact that aeronautical shares were driven to impossible heights in the heyday of public participation in the group—and which was responsible for the untimely formation of so many small companies which from their very inception never had the ghost of a show.

According to the record, in September, 1928, the Standard Statistics Company, Inc., conducted a survey of the aeronautical industry covering some 43 independent units engaged either in the manufacture of airplanes, engines or the transporting of air mail. The trend noted was a marked disposition toward consolidations. Eventually, all sorts of rumors of impending consolidations began finding their way into print. The interest in aeronautical securities became more and more pronounced as can be gleamed from the accompanying table which shows that on Feb. 15, 1929, the shares of airplane, engine, and air transport companies analyzed by Standard Statistics had a market value of $447,607,954. Moreover, this by no means covered the field, any number of concerns being eliminated from the survey because of lack of essential data, as to capital structure, etc., which made comprehensive study impossible. Finally, the figure cited only takes into consideration the evaluation of the common stocks of the respective enterprises whereas at least $15,000,000 in preferred issues were then outstanding.

Additional flotations in conjunction with a substantial rise in the market value of aircraft shares resulted in the aggregate valuation on the issues analyzed by Standard Statistics as of May 25, 1929 amounting to $623,952,358. If, to this total the market evaluation of smaller companies were added, the full amount would have exceeded the preposterous sum of $1,000,000,000.

THE AUGUST SURVEY saw the amount at $567,111,845. It must be remembered that these were not the highest quotations for the year which took market appraisals well over $700,000,000. Patently, unbounded speculation alone could have created these fictitious values.

True, a few of the stocks may not have been enormously out of line with the individual earnings prospects of some concerns but in toto the thing was absurd. So absurd in fact that the revaluations as shown in the last survey by Standard Statistics, as of Nov. 28, 1929 reveals that the loss in market value of these selected aeronautical shares was $349,312,200 in 6 months with the total now down to $274,640,158, or a sum less than the stock market value placed on the shares of United Aircraft alone earlier in the year. (The common and preferred shares of U.A.T.C. reached a market valuation peak of about $280,000,000 in April. Ed.)

To propound that those buying aeronautical shares at the peak market prices, or at any price at all under the circumstances set forth, were contributing capital for the sole and express purpose of assisting aviation to find its feet is, therefore, to misstate the case. Indeed the thought might even be advanced that every dollar finding its way into assisting the promotion of unnecessary new companies was in point of fact detrimental to the best interests of the industry.

The prominent mergers and consolidations of 1929 did much to check the "wildcat" promoter. The industry started to settle down. A replacement demand began to assert itself and there has been an encouraging growth in the number of commercial miles flown.

Why then the air of pessimism? Because plane stocks have dropped to levels more in line with actual values? Because new financing of aviation enterprises is not the hot stuff it used to be? Because the situation in remedying itself will sound the death knell of the weak? Because there has been overproduction, and the matter of inventories to be moved is still to be faced? Because the anticipated demand for two-place jobs, especially, has so far failed to come up to expectations? Or what?

Take any of the foregoing queries and each can be looked upon as a constructive development in the final analysis. Obviously it will require work to build up the industry but the foundation at least will be solid and very far removed from the extravagant ideas that were implanted in the minds of public and manufacturers alike by the subtle words penned by pools and promoters while aeronautical stocks were being taken for a joy ride.

Air Transport

DEVELOPMENT IN

A Review of Last Year's Phenomenal Growth and a

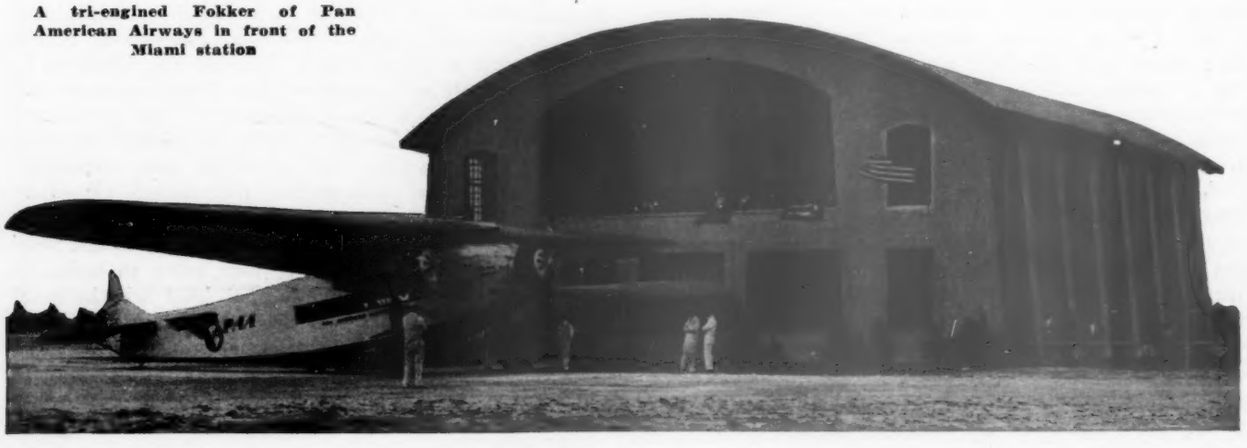
IN DEVELOPING regularly scheduled passenger transportation by air during 1929 America has created something which did not exist before in this country or any other. While air travel has been commonplace in many parts of the world, the development of an air transport industry based upon private capital investment without government participation or subsidy is peculiar to the United States. In no other country has the development of scheduled air travel been so dependent upon the enterprise of private citizens, and so divorced from matters of government policy, military or otherwise.

The history of air transport development in this country provides the background for the history of all commercial aviation. In 1927 there was no passenger transport broadly speaking, aerial activities being almost entirely confined to the air mail and "aerial service" and joy-riding. In 1928 the foundations of an enlarged air transport structure were being laid. The year 1929 has witnessed the development of a network of air routes linking together the major cities' airports with regularly scheduled passenger services. It is evident that during the boom period and subsequent slump in the aeronautic industry, air transport has steadily progressed as the framework around which a permanent aeronautic industry may be erected. Transport lines provide a steady market for equipment, upon which commercial factory operations may be predicated. Transport flying operations develop a permanent air traffic of constantly increasing proportions. The individuals who go to make up this transport traffic represent the reservoir of air-minded persons to whom can be sold the planes, aeronautical products, or other services which the industry offers to the public.

RECOGNIZING this relation between air transport development and the general growth of the aeronautical industry, aircraft and aircraft engine manufacturers, aeronautical executives, and large investors have provided what amounts to a private subsidy of air transport, tremendous amounts of money having been poured into this development during 1929. It is estimated that $3,000,000 was expended on developing the facilities of Transcontinental Air Transport alone before the first public flight was made. The difference between this private subsidizing and the subsidies provided European operators by their respective governments lies in the fact that the governments do not expect to receive back any of their money, whereas the American private investors are counting upon future profits to bring back the original outlay plus a substantial cash profit.

The phenomenal growth of American air transport

A tri-engined Fokker of Pan American Airways in front of the Miami station



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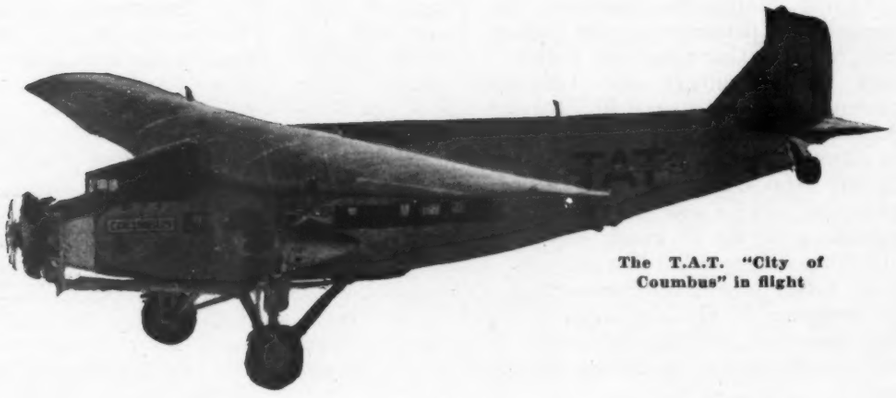


The T.A.T. "City of Coumbus" in flight

Forecast of Future Progress

By CHARLES F. McREYNOLDS
Pacific Coast Editor of AVIATION

operations during 1929 proves the American policy to be correct, at least for American conditions. Not only have air routes been extended to all important points, and passenger traffic totals boosted, but the most intensive attack upon every problem connected with air travel has brought such great progress during the one year of 1929 that air transport gives every evidence of being headed for a profitable footing. Adequate terminals have now been provided generally throughout the country, various routes have taken steps to synchronize their schedules to better advantage, both with each other and also with existing water, rail, and bus lines; the number of schedules per day is rapidly increasing; size of equipment in use has in some cases tripled; night flynig is already becoming popular; and progress is being made in the solution of dozens of technical problems such as fog flying, radio communication, radio beacon development, and radio direction finding.

Whereas in 1928 the United States operated but 16,667 mi. of airways as compared to 18,540 for Germany, the leading European country, the figure was increased to 35,000 miles of airways for this country before the close of 1929 while no European country extended its air routes appreciably. In passengers carried the United States has jumped from 49,713 in 1928 to approximately 85,000, for 1929, but still trails Germany, whose 1929 total was approximately 115,000, about the same figure as for 1928. In passenger miles, however, the United States unquestionably leads the world, since our most heavily travelled routes are considerably longer than those of Europe.

IN AIR MAIL the United States continued to lead with a total poundage for the year of approximately 8,000,000 as compared with less than 2,000,000 lb. carried by France. The fact that the United States, hopelessly outclassed by Europe in 1928, is now regularly operating more miles of air routes, and flying more passenger miles than any other two countries of the world put together, is probably the best index of the strides this country has made.

The fact that established airway miles approximately doubled during 1929 is chiefly atributable to the inauguration of new passenger routes, rather than to mail routes, as a national air mail network was well established by the close of 1928. Some 40 new routes were listed by the Department of Commerce during 1929, of which 24 were passenger lines exclusively. This condition is probably best illustrated by the developments which occurred on the Pacific Coast during 1929. The mail routes there at the start of the year were not added to during the entire year, the only changes being that Boeing and Western Air Express inaugurated the twice-daily schedule over the established transcontinental mail route. Passenger route miles were increased from approximately 4,600 mi. at the end of 1928 to 9,920 mi. at the close of 1929, and miles flown over passenger routes increased from 9,200 to 25,000 per day. Over one route, Los Angeles to San Francisco, the number of daily schedules was increased from two each way daily to ten each way daily. So miles of passenger routes approximately doubled, miles flown daily tripled, and at least one schedule was increased to five times the original number of daily arrivals and departures. Although progress has been exceptonally rapid on the Pacific Coast, somewhat the same general ratio of development holds true for the country generally.

A BRIEF CHRONOLOGY of transport development for the year brings out a number of interesting high lights. On January 2, 9 adn 11 respectively the Pan American routes from Miami to Nassau; Miami to San Juan; and Cristobal, Canal Zone to Miami, were inaugurated carrying mail three times weekly. This was our first great step toward comprehensive air service between North and South America, and these services will eventually, so it is presumed, be the basis for a great system of intercontinental commercial airways. On Jan. 23, Southern Air Transport started the Houston to New Orleans mail route.

On February 4, Standard Air Lines, of Los Angeles, extended its tri-weekly Los Angeles-Tuscon service to El Paso, Texas on a daily schedule and by effecting a working agreement with the Texas and Pacific Railway inaugurated one of the first, if not the very first air-rail systems. Another outstanding development of the month was the formation of the Pacific Coast Aerial Express. Operating a pickup and delivery service in conjunction with eight air lines, it represented one of the first efforts to develop a comprehensive aerial express system.

During March the Southern Air Transport lines opened daily passenger service between Brownsville and San Antonio, Galveston and Dallas; Texas Air Transport (later Southern Air Transport) started daily passenger service between El Paso and Dallas, and Pan-American Airways opened the first direct air mail route to Mexico City, operating daily from Brownsville, Texas. Also during March a San Diego-Los Angeles passenger service was started by Pickwick Airways, a subsidiary of the Pickwick Bus Co., representing the first entry of major bus-line interests into airways operations. Other important developments of the month were the assigning of 33 radio frequency bands to air transport operators, and the installation of ground-to-plane radio communication by Boeing and National Air Transport.

During April the Southwest Air Fast Express (S.A.F.E.) was organized and began operations between Dallas and Kansas City, also Tulsa-St. Louis; Colonial installed a double daily passenger schedule on the New York-Boston route; and other routes were placed in operation by Southern Air Transport; Thompson Aeronautical Corp., flying passengers across Lake Erie with amphibians; Pitcairn; and Mamer.

May saw the inception of a double daily schedule on the trans-continental mail route, flying mail from coast-to-coast with the loss of but one business day; regular night passenger flying between San Francisco and Salt Lake City, by Boeing; the proposal of overseas Zeppelin mail and passenger routes by the Goodyear-Zeppelin interests; inauguration of the Santiago (Chile) - Cristobal (Canal Zone) route by Pan-American Airways, providing the first direct air mail link between the two Americas; and the inauguration of other routes by Western Air Express, Nevada Air Lines, Universal Air Lines, Pitcairn, Colonial, National Parks, Pickwick and Thompson.

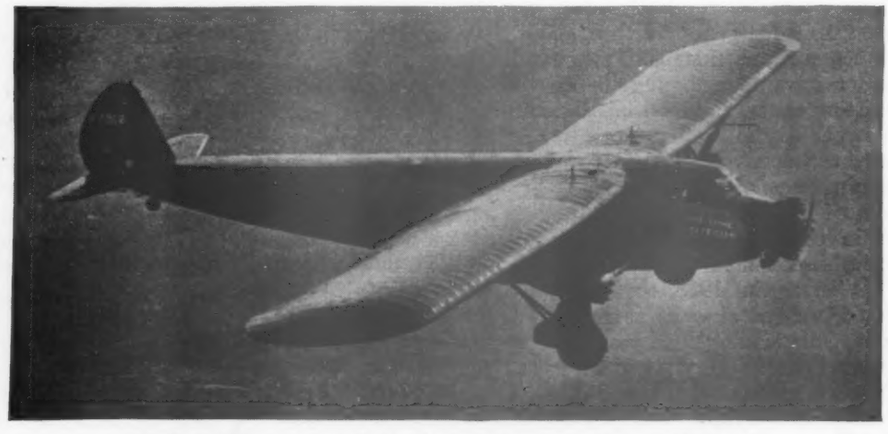
In June both Universal Air Lines and Western Air Express provided trans-continental air - rail passenger hook ups, the Western Air Express route between Los Angeles and Kansas City, 1300 mi., representing the longest daylight passenger route in this country. Other air-rail arrangements were effected in the mid-west by S.A.F.E. and Southern Air Transport lines; several lines began to introduce excursion fare rates to build up traffic; Verne Gorst started an aerial taxi service with 11 schedules each way daily across Puget Sound from Seattle to Bremerton; and a tri-weekly passenger service was placed in operation by Delta Air Service between Dallas and Birmingham, constituting the last link in a through air line service following the far southern route from coast to coast. Coastal Airways started several seaplane passenger lines along the Atlantic coast and Hudson River, while the Airvia Company used Savoia flying boats for an all-water service between Boston and New York, the first flying boat service operated primarily for passengers during this new era of air transport.

July was featured by the opening of the long awaited 48 hr. Transcontinental Air Transport service from New York to Los Angeles through the cooperation of the Pennsylvania and Atchison, Topeka and Santa Fe railroads. Further excursion rates were introduced; the Guggenheim weather reporting system on the Los Angeles-San Francisco route was taken over by the Department of Commerce; and various lines were started by N.A.T., U. S. Airways, and others.

During August there were further passenger rate reductions to stimulate volume traffic, and aerial express was inaugurated by Western Air Express, Curtiss Flying Services, and Colonail Airways in connection with Western Union messenger service. Pickwick Airways opened direct passenger, mail and express service between Los Angeles and Mexico City.

Routes started during September included a Seattle (Washington)-Alaska passenger air service using float-equipped Lockheeds; and other routes by Walter T. Varney carrying mail, and Midcontinent Air Express carrying passengers. A ground-to-plane mail-pick-up device was successfully tested, an inter-island service was started in Hawaii, and a Western Air Express-Universal Air Lines arrangement lowered the coast to coast air-rail schedule to less than 40 hr.

NIGHT FLYING, pioneered by the Boeing Company on May 1 with regular flights between San Francisco and Salt Lake City, was inaugurated by Universal Air Lines, Maddux Air Lines, and Western Air Express,



Action picture of a Colonial Air Transport Keystone "Patrician".

during October. On most of the routes where night flying was done with passengers, take-offs were made before dark, the plane continuing on to a landing some time after darkness. This innovation proved popular and was well patronized, leading to extensive plans for early night schedules on all leading passenger routes. Further rate reductions were made by S.A.F.E. and other lines during October. A model of the Armstrong seadrome was tested, and plans announced for a New York-Bermuda mail and passenger service, using 40-passenger Sikorsky amphibions in conjunction with one Armstrong seadrome anchored midway of the route.

During November Pan-American Airways made provisions for passenger flying over the Caribbean Sea air mail routes, a Los Angeles company was formed to handle air express only, and Kansas City-Denver passenger service was started by Mid-Continent Air Express.

December saw the operation of additional aerial ferry services at Chicago and San Francisco, providing water

A twin-engined Sikorsky Amphibion operated by Pan American Airways

to land field connections via amphibion planes; further testing of ground-to-plane mail pickup devices, and the wholesale reduction of fares to approximately de luxe rail rates by Western Air Express, T.A.T.-Maddux, S.A.F.E., and other routes. In three weeks after reducing fares, W.A.E. traffic on the S.F.-L.A. route jumped one thousand per cent from 45 to 450 passengers per week. Since the first of the year this policy of reduction of rates has spread until it seems inevitable that passenger rates throughout the country will drop to approximately the same level as rail fare. Complete consolidation of Maddux and Transcontinental Air Transport was announced.

At the present time almost every large city of the United States is served by a network of regularly scheduled passenger air lines. The northwest and far south sections of the country are the only portions now lacking adequate direct air transport services.

ALL OF this airway development has depended directly upon the Department of Commerce Aeronautics Branch for assistance in developing, marking, and lighting of routes, and in many other ways. Among the ways in which the Department of Commerce is constantly aiding air transport are: the establishing and enforcing of air trffiac rules; investigating and issuing reports on accidents, causes, and remedies; assembling general data on all phases of air transport; establishing and maintaining civil airways; equipping airways with navigation aids; providing weather reporting service; charting airways and publishing and distributing charts and maps of landing fields; research to improve and increase air commerce; publication of air commerce bulletins at regular intervals, encouraging the development of air ports and rating of airports; publishing airport data. It is readily apparent that without this cooperation from the Department of Commerce the great strides taken by air transport during 1929 would not have been possible. Without the continued help of the Dept., air commerce would be hopelessly crippled.

Considerable changes were made during 1929 in the average characteristics of flying equipment. The tendency has been toward constantly higher speeds and much greater carrying capacities. At the beginning of the year most of the transport planes in service had a maximum capacity of ten passengers. At the close of the year there were 15, 18 and 20-passenger planes in regular service and the new Fokker F-32, 30-passenger plane was scheduled for regular transport work early in the year 1930, with other designs to carry approximately 40 passengers each now under development by Sikorsky and others. Among the outstanding transport planes developed in this country during 1929 were the Fokker F-32, Consolidated "Commodore" 20 passenger seaplane; Boeing and Keystone "Patrician" 18-passenger planes and the Curtiss "Condor" for 20 passengers. There were no rapid changes away from existing types, most changes being of a detail nature.

Successful night flying with passengers, first by Boeing, and later by others, indicates the early establishment of night schedules over most of our present routes, thus effecting tremendous time savings for business men. The night plane "Sleeper" is still an untried experiment and it may take some little time to educate the flying public to sleeping in the air.

RAPID PROGRESS was recorded during 1929 in the development of plane-to-ground two-way radio communication by the Bureau of Standards, T.A.T., Boeing, and others; the radio-echo altimeter showed promise in tests; much progress was made in developing radio compass installations and in providing radio marking of airways. Based upon the progress of the past year 1930 will be sure to show much greater dependence upon the radio for fog and night flying, dispatching, control of planes in flight, weather reporting, etc.

In line with other advances was the progress recorded in providing ample ground facilities for transport planes. There is an increasingly evident tendency to separate transport and general flying, and it seems inevitable that all transport terminals of the future will bar miscellaneous flying.

Although complete figures are not yet available on all accidents of 1929, the record for the first six months for transport flying was one death for approximately 1,000,000 miles flown. Probably the figures covering the whole year will be a bit worse, as there was one calamitous accident and several minor ones during the last

A Transcontinental Air Transport plane at the Columbus, Ohio, station

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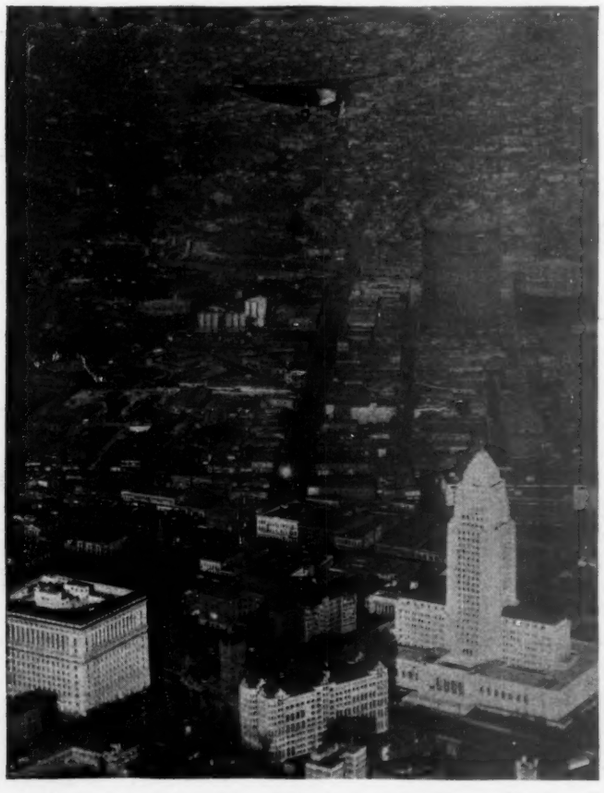
six months, but as a general thing the public is gaining confidence in air travel.

Rates have been a source of constant worry and experiment. The final lowering of rates to the level of rail fare has been an open admission of the now recognized fact that there are not enough people, even in America, willing to pay the high premium originally charged for the economy of time due to travel by air. Now that the rates are down it will prove most difficult ever to increase them, largely due to the fact that during last summer rate reductions were announced as "summer excursion rates" and consequently the public will look for more such, even though the rates be low the year round. Since we must have volume of travel before we can even find out what possibilities there are in air transport, it is almost inevitable that air rates will continue at a low level, with every effort made to reduce the cost of operation, in order to show a profit. Probably no air line showed a profit during 1929 on straight passenger carrying, but some were able to pare their losses encouragingly.

The air transport industry developed rapidly from a large group of miscellaneous air lines at the start of 1929 to a comparatively small number of consolidated systems by the close of the year. Railroads are taking an active interest in developing air travel, as are bus and steamship lines. Also, as the airline represents the most substantial market for airplanes, the factories have helped to bring about consolidations so that we enter 1930 with such strong groups as United, with Boenig, P.A.T., and Stout airlines; Aviation Corp. of America with Universal, Colonial, Southern Air Transport, and Interstate Air Lines, while the General Motors-Fokker-Western Air Express group represents a third type of business association, more loosely assembled than a merger. There are two beneficial results to be expected from this tendency, the first being to tie air transport directly to other activities of the aeronautical industry so that they will rise or fall as one body. The second and more important is the prospect of a universal travel service providing synchronized air, rail, water, and bus connections through the steadily increasing number of consolidations and working agreements. This latter phase of air transport came rapidly to the front in the latter part of 1929 with arrangements by Maddux Air Lines, Western Air Express, Universal Air Lines, Pan-American Airways, and others, to provide rail, water, and air schedules to include various combination tours of the country.



A Western Air Express Fokker over Los Angeles, Calif.

During 1929 the public accepted passenger air transport in rapidly increasing numbers and there can now be no question as to whether or not there is need for such a service. Technical work now under way both in connection with aviation and other fields of scientific development, promises such rapid improvement in all types of equipment as should make air transport both popular and profitable. Night sleepers keeping in constant communication with operations bases by two-way radiophone, as well as holding a course by radio aid, are not at all visionary. Increasing comfort is to be expected in planes, and the effort of the designers for improved efficiency and economy is constant. What effect lighter than air equipment will have on air travel cannot yet be predicted, but the performances of lighter-than-air craft during 1929, and the projects now under way in this country, lend great interest to the consideration of airships in connection with any sort of air transport system.

THE ONE outstanding failure to be chalked up against 1929 air transport development is the lack of consideration so far given to developing aerial express. Other countries far outstrip us in this activity and since no other transport medium has ever earned profits consistently on the carrying of passengers only, it seems urgent that we should develop express and freight services as rapidly as practicable. The possibilities for profit, if such a traffic can be generated are most alluring. Many companies are now planning to enter, or have already entered the aerial express field. Mr. Robert E. M. Cowie, president of Railways Express Agency, has said that what is needed is an express plane capable of carrying loads of 20,000 lb. Of course many potential express shipments are already being sent by air mail, and the dividing line between the proper fields of the two types of service is somewhat indistinct.

During 1929 the transport companies have experimented with every factor bearing on their operations. Equipment, personnel, organization, fares, schedules, advertising, and routes have all been the subject of experiment. We enter 1930 with this period of experiment behind. It is now known that there is a definite need and that people will fly in appreciable numbers, but it has been demonstrated that we need low fares, better terminal connections and better synchronization with other transport systems, more frequent schedules, the closest attention to comfort and convenience. and consistant advertising of safety records in order to break down the now recognized reluctance which many persons feel towards the idea of leaving the ground. Upon these things, along with technical progress, the transport lines will concentrate during 1930, with the result that an increasing acceptance of air transport, backing up the phenomenal strides made during 1929, can be expected to raise an ever increasing percentage of American travel and commerce into the air.

LAST YEAR'S Airport Construction PROJECTS

By CHARLES H. GALE
Assistant Editor of AVIATION

WHILE most other departments of aeronautical activity were having their ups and downs in 1929, the important work of constructing airports continued to forge steadily ahead in all sections of the country. There were individual cases of retrenchment here and there as modifications appeared wise in the light of changing conditions but, for the most part, the work of installing new airports and landing fields or improving established institutions made extremely gratifying progress. When the year closed the country was richer by close to $50,000,000 worth of new airport construction and approximately 108 new municipal and commercial airports in operation; which brought the total of the two classes in operation, excluding federal fields, to about 948. Including the federal fields there are 1,554 ports in this country today.

It is quite difficult, if not actually impossible, to secure an accurate accounting of the various items of construction and the amount of money actually spent on them during the year. The announcements of various projects are couched in dissimilar terms which do not lend themselves readily to consolidation and classification. In order to secure some index of last year's construction and the nature of the individual projects involved, a study has been made of the reports received by AVIATION for the year with only those items representing construction completed or actually under way included. Derivation of a satisfactory index is handicapped further by the fact that many projects have been reported to the magazine without enough detail to contribute to the statistics.

THE FIGURES, therefore, must be interpreted as preliminary and representative only. They may be considered to indicate a minimum, however. with the actual cost and volume of construction somewhat in excess of the amounts quoted. Because there were cases of hangar construction reported without any expenditures thereon included, or of acquisitions of airport sites without further reports of improvements, or of general development right through from the purchase of land to the inauguration of the plant, etc., it is impossible to make accurate cross-totals or similar comparisons. Canadian figures are included because of AVIATION's editorial policy of including Canadian with domestic news.

According to this compilation between $45,000,000 and $50,000,000 was spent in this country and Canada on

The club house and hangar at Tennessee's Sky Harbor, Murfreesboro, dedicated in October

airport construction work in 1929. This money was distributed in general as follows: About 85 new development projects, which included purchase of land, installation of buildings, lighting, etc., for a complete airport; about 100 hangars; about 30-35 administration buildings; about 60 airport sites, representing acquisition of the land only; about 30 cases of surfacing only, which included runways, etc.; and about twenty instances of miscellaneous installations, such as lighting, road building only, etc. Altogether there were in excess of 300 individual projects ranging from the general airport development to single items of hangar construction, surfacing improvement, etc. The majority of these, or about 175, were municipal projects and about 130 were private, that is, promoted by corporations or individuals.

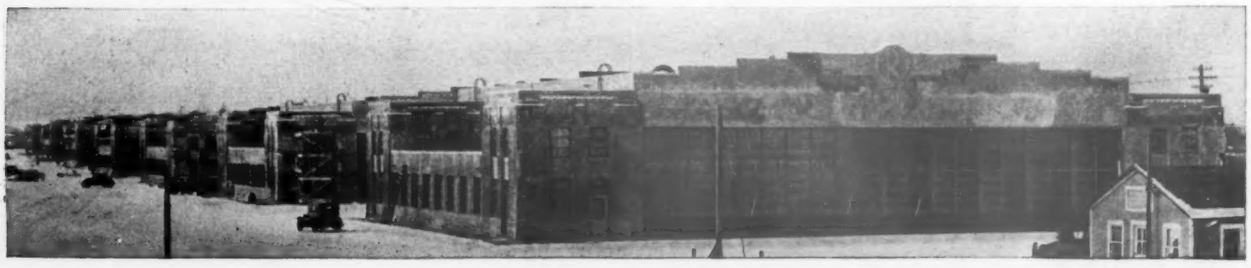
An outstanding project. The Akron Municipal Airport with airship dock

Keeping in mind that these figures are merely representative, we shall analyze the distribution of this work by geographical divisions. We shall consider East as comprising Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia. The South will comprise Tennessee, Florida, Louisiana, Texas, Virginia, West Virginia, North and South Carolina, Georgia, Alabama, Kentucky and Arkansas. Central will comprise Ohio, Illinois, Indiana, Nebraska, Kansas, Missouri and Iowa. The North Central will include North and South Dakota, Michigan, Wisconsin, Minnesota and Canada, while the West will include all the other states.

Surprising as it may be, according to this compilation the East led in the amount of money spent in airport projects. Our best estimate for this figure is between $13,000,000 and $17,000,000. There were between 55 and 60 individual projects, about 25 of which were municipal and about 35 were private. Twenty-three of these would be considered general development projects, under the definition given above. Narrowing this down to specialized improvements not involved in a general development program, we find that there were between sixteen and twenty hangars completed, a half dozen or so administration buildings, a few cases of surfacing improvements only, and eleven cases where acquisition of airport sites was reported without any further reports on developments. There were between fifteen and twenty airports dedicated in the East during the year.

IN THE SOUTH we find that about $5,000,000 was spent on various projects. There was about the same amount of activity there as in the East, with approximately 65 individual projects of all sorts reported. The majority of the projects in the South were municipal, there being about 40 or 50 of these with about 23 or 24 falling into the classification of private. There were about twenty general development projects, between fifteen and twenty hangars constructed, close to ten or a dozen administration buildings, and sixteen cases of airport sites purchased without further report of their development. There were five or six cases of concentration on surfacing improvements, and about twenty airport dedications.

Going into the Central zone, we come across the greatest amount of activity of all the sections of the country. There were about 90 individual projects, with the majority undertaken by municipalities. It was a small majority, however, since only about 50 municipalities were involved as compared with 45 private concerns. The money spent totaled about $10,000,000, and this was invested in about twenty general development projects which included the acquisition of land, installation of lighting, drainage systems, hangars, and other equipment to make the complete airport. Between 30 and 35 hangars were built, about ten administration buildings erected, and about fifteen cases of acquisition of airport sites without further report of developments thereon. There were about



The new $1,000,000 group of cement and steel hangars at Roosevelt Field, Garden City, L. I., erected by Roosevelt Field, Inc.

The pilots' hotel and one of the hangars at Tulsa; both were completed last year

fifteen cases of specialization on surfacing problems, and there were between 30 and 35 dedications.

In the North Central area, which includes Canada, we find less to report. About $2,000,000 was spent in this zone, with the municipal projects far outnumbering the private. According to this report, there were fifteen or twenty municipal projects, and five or ten private projects. There were three cases of general development, eight or ten cases of hangar construction, three or four administration buildings were erected, and about half a dozen sites acquired without further report of their development. There were about five or six instances of specialization on surface improvement, and about ten dedications.

In the West, we find much activity, with the municipal projects again outnumbering the private. There were between 50 and 60 municipal and about 35 private projects. A total of $9,000,000 or $10,000,000 was spent in this zone, or between twenty and 25 general development projects with hangar construction programs numbering about 30, administration buildings about a dozen or fifteen, airport sites acquired about fifteen. There were five or six instances of specialization on airport surfacing, and about 21 to 25 airports dedicated.

The chain idea of promoting and operating airports rather took a slump during the year and the Curtiss-Wright Airports Corp. was about the only one making much progress in this direction, with the exception of companies which have developed their own fields at different points. Among the latter are The Aviation Corp., Western Air Express, Transcontinental Air Transport-Maddux, etc.

A SURVEY of the sizes of the sites being developed, indicates the trend is toward larger areas. A number of the new projects approach 1,000 acres in size. Much of the work done during the year was to increase the size of airports already established, so that the various faults of obstruction, cramped landing and take-off areas, etc., might be eliminated. The doctrine preached several years ago at the outset of the present airport construction movement, to the effect that in general airports could not be too large, seems to be gaining converts. This is not due, it should be remembered, to any lack of performance on the part of the planes themselves, but rather to the volume of machines operating at given points. Safety and operating efficiency should increase directly with this increase in available area though the number of aircraft increase.

There was a definite trend throughout the year toward permanent type of construction in buildings. Steel, brick and cement types of construction seem to be gaining in favor, and the wood type of construction continues to serve the needs of many localities. This tendency toward permanence includes expensive concrete aprons, adequate heating systems, comfortable offices, well equipped shops, hard-surfaced runways, and similar installations. These are a further indication that the airport is becoming a firmly established institution.

The homeliness which formerly characterized the average airport is fast disappearing under the trend toward considerable attention to architectural details. The advent of architects in the field of airport designing has contributed to this tendency, so that the expensive and costly plants which are being erected at the present time are being built more and more with an eye to a general pleasing architectural design. Even landscaping is included in many of the improvement programs.

THE ADMINISTRATION BUILDING made its appearance at many airports during the year. This naturally follows recognition of the need for proper housing of executive and clerical staffs charged with the administration of the airport activities. In some instances these administration buildings have included hotel or club accommodations, in addition to the facilities for the executive functions.

Like work on a farm, the development of an airport never may be considered as actually done. The improvements and incorporation of refinements in the existing plant will just about go on forever. The pace of this development work will be faster in the next few years than it probably will be fifteen or twenty years from now when the period of initial installations has neared its close. This year will see a vast amount of additional or supplementary work as airport officials seek to keep their plants up to date and in step with the constantly changing conditions caused by other departments of aeronautics.

Most money this year will be spent, not on the continued refinements or improvements mentioned above, however, but on the completion of new construction started last year and the inauguration of entirely new projects. Many expensive and comprehensive programs are included in this category, the Aeronautics Branch reporting that it has listed about 1,400 new projects to be undertaken this year as compared with about 900 a year ago. Many of these projects represent only good intentions but they are at least potential with the possibility of actual work on them always imminent. It is reasonable to estimate that between $50,000,000 and $75,000,000 may be spent this year on these airports and the completion of plants already under development.

The idea of uniform architectural design schemes for

the entire airport plant will continue to gain headway this year. The trend in this direction is both interesting and important. Judging from the progress made in this direction in 1929 and the attractive designs characterizing many of the projects which have been announced for this year, it may be prophesied that a distinct period in airport architecture is at hand. Along with this goes the improvement in design, arrangement, location and construction methods and materials, a movement which was well under way last year. Meanwhile, the expansion in airport management, including field operations and finance will continue.

THE CAUSE of the airport was assisted materially in 1929 by the holding of a number of conferences on airport problems. Such affairs served to focus the representative thought of experienced men from various sections of the country on common problems and afforded the newer men in the field to increase their knowledge of the subject. This sharing of experience and opinions through contacts and rubbing of shoulders undoubtedly resulted in much more intelligent approach to the individual airport projects, with consequent saving of money and provision for more satisfactory equipment.

The lead in this movement was taken by the Aeronautical Chamber of Commerce through its Airport Section. This Section was responsible for the national airport conference at Cleveland in May and regional airport conferences at Boston, Bridgeport, Atlanta and Los Angeles during the Fall. Others are contemplated in an expansion of the program. The Aeronautics Branch of the Department of Commerce co-operated closely with the Section and its representatives offered papers based on information accumulated by the government in various studies of the national airport situation.

Airport discussions were held, also, by groups of professional men not specializing on airport construction. Such groups as the Asphalt Association and the American Roadbuilders' Association were included in this category. The latter made a conspicuous contribution by arranging a national conference on airports at Washington in October under the auspices of its City Officials' Committee. This, of course, was for the purpose of considering the opportunity in airport construction facing the road builders who have been concentrating on similar problems of drainage and surfacing for many years.

In fact, one of the notable trends of the year was for professions whose activities include problems akin to those involved in airport construction—such as drainage, runway installation, and the like—to make available their years of experience and knowledge to the newer institution of the airport. Because of the many ramifications of the subject, almost every one of the established lines of general construction and engineering can find something to do in aviation. Apparently this fact is gaining recognition, to the certain boon of the country's airport system.

The Airport Section of the Aeronautics Branch rendered much assistance to the industry through its program of expert advice on various projects and the accumulation and dissemination of helpful information. Following carefully planned itineraries representatives of the Section visited many communities seeking guidance in their airport plans. Individual trips were made from time to time, also, to important points asking aid. This work will be continued throughout this year.

Valuable contributions were made last year through competitions encouraging new and improved general designs of airports. These competitions emphasized particularly the wisdom of paying a great deal of attention in any airport project to the likely demands of the future. Visioning eventual passenger traffic of large proportions, these competitions sought to prepare particularly for improvement in public facilities and means of safety in the ground equipment. The Lehigh Airports Competition which closed in November and the English contest earlier in the year were promoters of such competitions.

Fairfax Airport at Kansas City, Kan., during its dedication the first week in August

1929 Design TRENDS

A Review of Airplane and Engine Design Tendencies

By LESLIE E. NEVILLE
Technical Editor of AVIATION

A STUDY of the approved type certificates granted to commercial airplane and engine designs during the year 1929 is probably the best available basis of comparison with former years and serves to indicate the general trend of development in the lighter than air class. The value of such an analysis is increased by the fact that nearly 200 airplanes were approved during 1929, where approximately 75 certificates were granted in 1928, and also by the greater individual effort on the part of designers and the larger quantity of original engineering work during the year. Figures and charts for 1928 may be found in the airplane design section of the October 5, 1929 issue of AVIATION.

The question of first importance in classifying designs is that of monoplane or biplane and the situation in this respect is shown clearly in Table I. In the first quarter of 1929, 33 per cent of the successfully approved designs were monoplanes. The percentage of this type

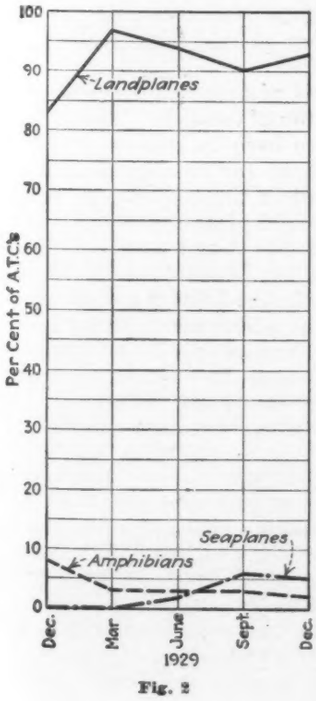


Fig. 2

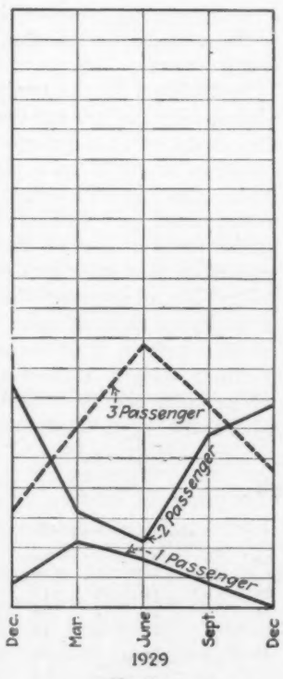


Fig. 3

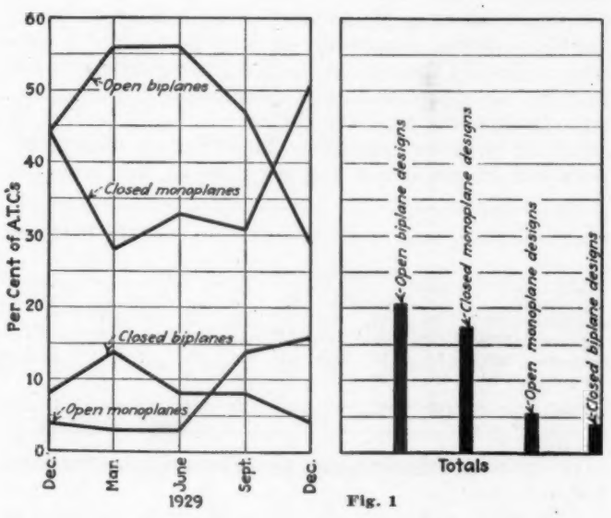


Fig. 1

of craft increased progressively to double that figure in the last quarter. Several factors are responsible for this, one of these being the increase in the proportion of closed airplanes which seem to be inherently monoplanes. Another is the increasing popularity of the low wing type of monoplane.

RETURNING for a moment to the first of these, it is interesting to note that the proportion of approved designs of closed monoplanes has increased rapidly during the last quarter of 1929, while that of the familiar open biplanes has decreased as shown by the curves in Fig. 1. These changes have not seriously affected the totals, however, and the open biplane designs still lead, as indicated in the chart appended to Fig. I. The open monoplanes have increased considerably during the last half year while the closed biplanes, which showed great promise during the first half, seem to have given away in the last quarter. This is probably due in a large extent to the previously mentioned increased proportion of low wing monoplanes designs that have been approved. There are however two noteworthy transport biplanes, the Curtiss Condor and the Boeing model 80-A, in actual service and this type makes a strong bid because of its lower unit wing loading.

The deplorable lack of sea planes or flying boats is clearly shown in Fig. 2, but it is not probable that this will continue, judging from the number of designers which has been recruited to meet the demand for this type of craft and for amphibians which also appear to have been neglected in the past but probably will not be in the future. Our available information does not, of course, show the proportion of land planes having flotation gear interchangeable with the landing wheels and, as is generally known, floats may be purchased as additional equipment for a great number of the existing types of land machines.

Referring again to Table I, it is noteworthy that

the proportion of two engine airplanes approved has decreased while that of three engine designs has increased slightly during the year, and also that a four engine plane, the Fokker F-32, has been approved.

THE LEFT HAND portion of Table II has been devoted chiefly to a break down of airplane design approvals on the basis of seating capacity, which in a sense is an indication of their classification by weight. Considering the proportion of single seat airplanes for the year, which has been plotted graphically in Fig. 3, we find a continuous descent throughout the last three quarters of the year and no approvals in this class during the last quarter. In fact, the total for the year is but 5 percent of all of the airplanes approved. These figures seem somewhat out of proportion for airplanes of this type and led to its diminution. The four and five seat types have increased threefold during the year and now constitute 14 per cent of the total approvals for 1929.

The proportion of six and seven seat machines and more particularly the eight and ten seat type seem to have suffered, while the proportion of aircraft accommodating more than ten passengers has doubled. This is undoubtedly due to the movement toward larger transport planes which has been in evidence during 1929.

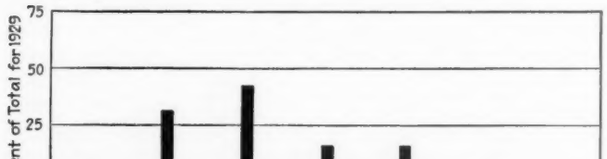
In the left hand columns of Table II are shown some interesting ratios which strangely enough have remained almost constant during the year. The first of these columns is devoted to average values of the useful load —gross weight ratio, the general average for the year being .37. In the second of these columns are given average values for power loading which decrease slightly

Table I—Airplane Design Tendencies

Period	No. New A.T.C.	Monoplane No.	Monoplane Per Cent	Biplane No.	Biplane Per Cent	Open No.	Open Per Cent	Closed No.	Closed Per Cent	Landplane No.	Landplane Per Cent	Seaplane No.	Seaplane Per Cent	Land and Sea No.	Land and Sea Per Cent	Amphibion No.	Amphibion Per Cent	Two-Engine No.	Two-Engine Per Cent	Three Engine No.	Three Engine Per Cent	Four-Engine No.	Four-Engine Per Cent
1st quarter, 1929	36	12	33	24	66	20	55	16	44	35	97	0	00	0	00	1	03	2	05	2	05	0	00
2nd quarter, 1929	36	13	36	23	63	21	58	15	41	34	94	1	02	0	00	1	03	1	02	2	05	0	00
3rd quarter, 1929	71	31	44	40	56	45	63	26	37	64	90	4	06	1	01	2	03	1	01	6	09	0	00
4th quarter, 1929	44	29	66	15	34	19	43	25	57	41	93	2	05	0	00	1	02	1	02	3	07	1	01
Total.....	187	85	45	102	55	104	56	82	44	174	93	7	4	1	1	5	3	5	3	13	7	1	01

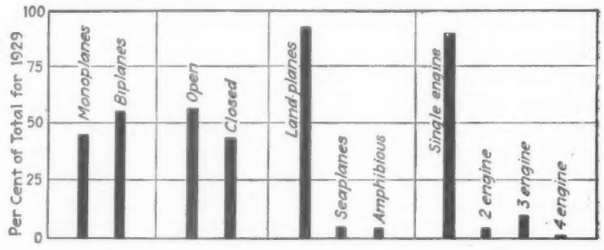
it is the writer's belief that there is a definite demand for such craft.

The rapid stride of the two seat type, partially at the expense of the conventional three place planes, is obviously due to the demand for airplanes designed specifically for sport and training. Another equally important influence in this case has been the virtual disappearance of the OX-5 engines remaining available following the close of the war and the tremendous demand for a low priced substitute for this engine. This gradual decrease in proportion of three place planes may be attributed also to an even more significant cause,—the increasing unity of purpose in airplane design. During the early stages of the industry the three place open cockpit biplane served well as the backbone of production and the "all purpose machine" but as demand became more definitely defined the evolution of this highly serviceable type together with other determining factors have



Above: Chart showing proportion of total approvals for 1929 classified as to seating arrangement. Below: Seating arrangement classification by quarters of 1929. Average values of wing loading, power loading and useful load gross weight ratio at right

Above: Table showing design tendencies by quarters (continued in Table II). Below: Chart showing total proportions of types for the year



throughout the year, the general average being 15.7. The third column is devoted to wing loading averages and it is interesting to note that the year's average of 10.8 is the same as that of the first quarter, while that of the last quarter is 11.8.

In addition to the analysis of approved types several outstanding factors are worthy of mention. Taking first the airplanes as a group, we have the almost universal adoption of metal as a material for fuselage structures, while wood is still employed in the majority of wings in the small and medium weight planes. An innovation in the form of spruce members cut and delivered to the manufacturers specifications has been introduced by the Posey Manufacturing Co. In the heavier classes metal is employed in most cases throughout the structure. The tubular section is still used extensively in the low and medium weight classes of steel fuselage construction while open section members are employed extensively where the light aluminum alloys are used in airplane

Table II

Period	No. New A.T.C.	Single Seat No.	Single Seat Per Cent	2-Seat No.	2-Seat Per Cent	3-Seat No.	3-Seat Per Cent	4 and 5 Seat No.	4 and 5 Seat Per Cent	6 and 7 Seat No.	6 and 7 Seat Per Cent	8 and 10-Seat No.	8 and 10-Seat Per Cent	Over 10-Seat No.	Over 10-Seat Per Cent	Average Ratio Useful Load to Total Weight	Average Power Loading	Average Wing Loading
1st quarter, 1929	36	4	11	6	16	11	30	3	08	6	16	4	11	2	05	.40	16.5	10.80
2nd quarter, 1929	36	3	08	4	11	16	44	5	14	5	14	0	00	3	08	.38	15.1	11 30
3rd quarter, 1929	71	3	04	22	30	24	34	7	10	10	14	4	06	2	03	.37	14 0	10 47
4th quarter, 1929	44	0	00	15	34	10	23	11	25	3	07	1	02	4	09	.38	13 5	1. 80
Total.....	187	10	05	47	25	61	33	26	14	24	13	9	5	11	6	.37	15.7	10.80

Table III

Period	No. of A.T.C.	Average Output Hp.	Average Output R.p.m.	Cooling: Air Cooled No.	Air Cooled Per Cent	Water Cooled No.	Water Cooled Per Cent	Cylinder Arrangement: Rad'l No.	Rad'l Per Cent	Vee No.	Vee Per Cent	Vert. in Line No.	Vert. in Line Per Cent	Inverted in Line No.	Inverted in Line Per Cent	Horsepower Range: 21–50 Hp. No.	21–50 Hp. Per Cent	51–50 Hp. No.	51–50 Hp. Per Cent	101–150 Hp. No.	101–150 Hp. Per Cent	151–200 Hp. No.	151–200 Hp. Per Cent	201–300 Hp. No.	201–300 Hp. Per Cent	301–400 Hp. No.	301–400 Hp. Per Cent	401–600 Hp. No.	401–600 Hp. Per Cent	Over 600 Hp. No.	Over 600 Hp. Per Cent
1929 (to July)	12	287	1,925	9	75	3	25	8	67	3	25	0	0	1	8.33	0	0	3	25	2	16.6	1	8.33	2	16.6	0	0	3	25	1	8.33
1929 (July to Dec.)	11	209	1,900	11	100	0	0	9	82	..	..	1	9.09	2	9.09	0	0	3	27.27	3	27.27	2	8.18	1	9.09	0	0	2	18.18	0	0
Total	23	...	.....	20	87	3	13	17	74	3	13	1	4	1	9	0	0	6	26	5	22	3	13	3	13	..	..	5	22	1	4

Table IV

Period	No. of A.T.C.	Number of Cylinders: 3–Cylinder No.	3–Cylinder Per Cent	4–Cylinder No.	4–Cylinder Per Cent	5–Cylinder No.	5–Cylinder Per Cent	6–Cylinder No	6–Cylinder Per Cent	7–Cylinder No.	7–Cylinder Per Cent	8–Cylinder No.	8–Cylinder Per Cent	9–Cylinder No.	9–Cylinder Per Cent	12–Cylinder No.	12–Cylinder Per Cent
1929 (to July)	12	0	..	1	8.33	1	8.33	..	..	3	25	1	8	3	25	2	17
1929 (July to Dec.)	11	0	..	2	18.18	1	9.09	1	9.09	4	36.36	0	0	3	27.27	0	..
Total	23	0	0	3	13	2	9	1	4	7	30	1	4	6	26	2	9

structure. This is of course a generality and in one case duralumin tubes are used in the wing and fuselage structure of a large commercial airplane. As regards covering material, fabric still predominates, particularly in the case of wings. Plans were being made in the case of one airplane to use bakelite for fuselage covering and plywood also has been used as before in isolated cases. Metal covered fuselages and wings are still being incorporated in designs while a slight tendency toward the monocoque fuselage and promise of a wing of monocoque type has been observed. More specification materials and progress in material control is noticeable and realization of the possibilities of stainless steel application has been reached by airplane manufacturers.

Although perhaps not belonging essentially to 1929, the wing structure of the Barling NB-3 is particularly

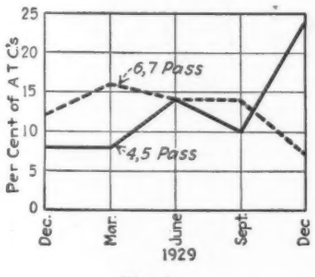


Fig. 4

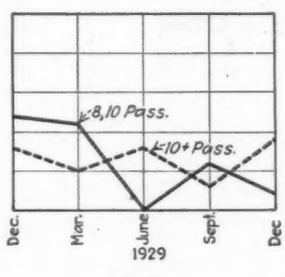


Fig. 5

worthy of mention because of its originality. This together with a monospar wing developed in Great Britain indicate that perhaps the conventional two spar arrangement may be modified some time in the future. Strength is also lent to this belief by the interest shown by some engineers in the question of wings having three or more spars.

From an aerodynamic standponit the keynote of the year has been cleanness of design gained by reduction of parasite resistance in a number of different ways; a realization of the relatively large proportion of the drag contributed by landing gears as well as outboard engine mountings, and a definite tendency toward better streamlining. This is indicated by the large number of low wing monoplanes of the so called "bullet" type, one of which attained a speed of more than 200 mi. per hr. with a 300 hp. engine. A study of aerodynamic interaction of various units of the airplane structure has begun. Streamline fairings for wheels and fillets for sharp corners have been seen in increasing numbers and the commercial development of the N.A.C.A. type radial engine cowling has begun. The adaptation of the British Townend ring, in annular surface placed around

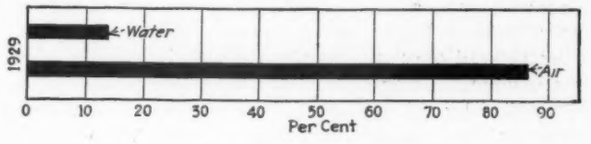


Fig. 6

at some distance from the cylinder heads, also is noticeable to some extent in this country.

The relative value of variable lift devices and of various means to produce lateral control at critical angles of attack have been reviewed in the Guggenheim safety aircraft competition which has been reported in several articles in AVIATION, while remarkable success has been achieved in the use of floating wing tip ailerons and the mechanism for their control in the Curtiss Tanager which was described completely in the previous issue of AVIATION. Although not as readily apparent as some of the other fruits of the Guggenheim competition, the improvements in methods of testing airplane performance should certainly not be forgotten. The year has marked the introduction of the Autogiro in America and a number of successful test flights of this type of craft.

THE ATTEMPT to build larger aircraft for commercial use and the adaptation of military to commercial designs has been one of the outstanding tendencies of the year, notable examples being the Fokker F-32, the Curtiss Condor and the Consolidated Commodore. While we are concerned primarily with developments in America, a review of the year would be incomplete without mention of the successful flights of the Dornier Do.X flying boat with 169 passengers and of the Junkers G-38, the world's largest land plane. A consideration of over seas achievements must also include mention of the British dirigibles R-100 and R-101.

Progress has been made in utilizing specialty manufactured parts and cooperation of the specialty manufacturers has been very close. Availability of ball bearings for pulleys and control hinges has resulted in a great improvement in control system reliability and in greater ease of control of airplanes. Introduction of the Mus-

selman air wheel already has made an impression and its further use may have a profound effect on landing gear design while tail wheels made possible by brake development are also being used in increasing numbers.

More attractive cabin interiors and a tendency to follow automotive practice in this respect is noticeable and greater comfort has been provided for passengers in transport planes. The use of indirectly lighted instru-

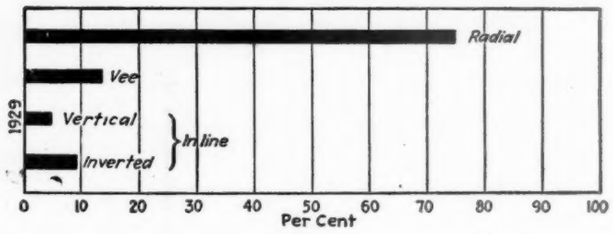


Fig. 7

ment boards, learned also from the automotive industry, is noticeable. New and improved instruments have been developed and electricity is playing an ever increasing part in improving the instrument equipment of the transport plane. Radio developments include the General Electric radio echo altimeter, which is rapidly nearing the production stage, and the twelve course radio beacon developed by the Bureau of Standards. In the lighter-than-air field the successful test flights of the ZMC-2 metal-clad airship is a definite accomplishment.

TENDENCIES in engine design are more difficult to determine by the analytic method followed in the case of the airplanes because of the relatively few engine approvals. However, some interesting results have been obtained, as shown in Tables III and IV. In the first columns of Table III an average value for the output of engines approved during 1929 is presented, this value being 209 hp. at 1900 r.p.m. In the adjacent columns the proportion of air and water cooled engines is shown, these values having been presented in chart form in Fig. 6. Referring to Table III, it will be obvious that there were no water cooled engines approved during the last half of 1929 and during the first half 25 per cent of the approvals were granted to engines of this type. By referring to the Department of Commerce list of approved type certificates for engines it is obvious that those in the water cooled class are chiefly in a horsepower range above 500, while the bulk of the lower powered engines are air cooled types. Judging from these figures it seems probable that the upper limit for air cooled engines is at present between 500 and 600 hp.

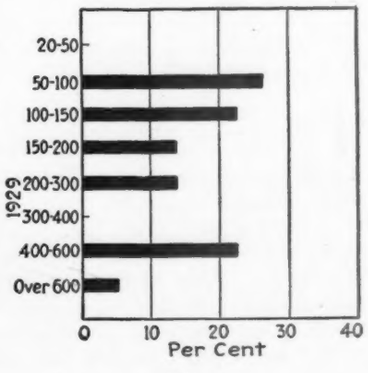


Fig. 8

The question of horsepower range also enters into the problem of cylinder arrangement although this is not shown clearly in the table. It seems, however, that the tendency is for engines between 100 and 600 hp. to be of the radial type, while those below this range are in-line and those above are Vee type. No approvals of Vee type engines were made during the last half of 1929 and the total proportion for the year is much below the proportion for the first half. The radial appears to be on the increase as is also the inverted in-line type, while the vertical in line remains constant, as shown by the values for the year in Fig. 7. In the classification on the basis of horsepower range the most significant changes seem to be found in the 101 to 150 hp. and 201 to 300 hp. band. The first of these classes has increased from 16 to 27 per cent, giving a general average for the year of 22 per cent, while the second has decreased from 16 to 9 per cent, providing an average of 13 per cent for the year. In the 401 to 600 hp. class there has been some decrease and a state of inactivity is noted in the range above 600 hp. and below 50 hp. Not a single engine in the 301 to 400 hp. class has been approved by the Department of Commerce at any time. The proportion of engine approvals on the basis of power output is shown in Fig. 8.

As to the number of cylinders, shown in Fig. 9, and Table IV, it seems that the seven cylinder still leads with the nine a very close second, this of course being due to the predominance of radial types. Third in point of numbers is the four cylinder and this is due to the popularity of this type in both in-line and vertical forms for relatively light planes. Fourth in importance is the five cylinder which, like the four, has been developed to replace the OX-5 or increase the performance of the airplane formerly using that power plant.

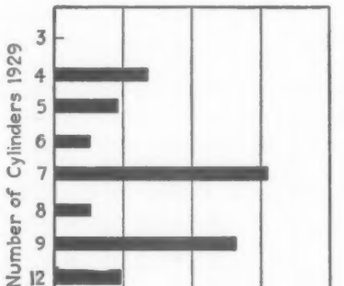


Fig. 9

THE TWO outstanding engine developments of the year are probably the successful non-stop flight from Detroit to Langley Field, Va., of a Stinson monoplane powered by the Packard Diesel engine and the research conducted by the Army Air Corps in the use of ethelyne glycol (Prestone) as a substitute for water in high temperature liquid cooling. The reduction in radiator area as well as other advantages accruing from this research has already found commercial application in the form of several planes produced by the Curtiss Company and there is still more research work to be done. An increasing use of magnesium alloy is also noticed in aircraft construction and the geared and supercharged types of engines seem to have obtained a definite foothold in America. Progress has also been made in the methods of production of aluminum alloy as well as steel forgings for aircraft engines.

Tandem engine installation necessitating pusher propellers seems to be attracting the interest of engineers and the use of relatively long drive shafts to transmit power from engine to propeller has also been made in at least two cases, that of the Bellanca "Tandem" and Junkers G-38.

1930 *Airplane Design*

Leading Engineers and Plane Builders Venture Their Opinions of the 1930 Trend in Airplane Design

AS A corollary to our inquiry on the general trend in the aircraft industry (see page 290) we have also sought the collective opinions of leading airplane designers and chief engineers of prominent manufacturing companies upon the probable course of technical evolution. As in the general questionnaire, we have addressed to those asked to contribute certain specific questions, to wit:

1. What is the general trend of design likely to be, and in what phase (aerodynamic, structural, or cleanness of detail) is greatest progress likely to be made?

2. How much further evolution is to be expected in the near future in the design of very large planes? Do you expect to see projects initiated by responsible and experienced companies during the next year for machines larger than any so far built?

3. How much increase is there likely to be in the use of aerodynamic novelties and striking departures from accepted form, such as the slotted wing?

4. Which way will the weight of favor swing in the controversy between cantilever and externally braced wing trusses?

5. What will be the trend of unit wing loading during the next year of design? Will it continue to rise as for a number of years past, or has a check been reached?

6. Are aspect ratios likely to increase, decrease, or remain approximately constant on the average?

7. Is further progress of metal construction at the expense of wood to be looked for in the immediate future? If so, how rapid is the displacement of wooden wing spars and other structural members likely to be?

8. Will metal construction continue to be predominantly of duralumin or do you anticipate a growing interest in structures of alloy steel strip?

9. What developments are to be looked for in the near future in landing gear design? Do you anticipate the use of larger shock-absorber travel and generally softer landing gears? Do you look forward to the use of wider or narrower treads? Are any striking modifications likely to be made on the landing gears of light planes to reduce the probability of nosing over?

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AS IN the previous case, also, some of our correspondents have made specific and separate answers to the several questions, and have used numbers corresponding to those employed in the lettes and just enumerated.

There are considerable differences of opinion upon most of the topics suggested for discussion. On the whole, however, it seems to be believed by most of those turning in replies that no very radical innovations are to be expected in design, that the cantilever monoplane will continue to gain in favor, that unit wing loading will remain where it is or decrease somewhat, and that for commercial and technical reasons, or both, further interest in giant airplanes is unlikely for the immediate

future. There is, of course, a substantial minority opposition to all these majority views. Upon aspect ratio it is hardly possible to arrive at a consensus, except that there is no definite indication of an anticipated general departure from present practice in either direction. It is generally although not by any means unanimously, agreed that metal construction will continue to progress at the expense of wood, and a surprising number of contributors speak favorably of steel construction and of the desirability of further study of that material.

Concerning the development of landing gears, the general tendency is to anticipate somewhat larger shock-absorber travel and "softer" gears but without any general increase in tread. Particular interest is displayed in the probable effect of the introduction of the air-wheel, so-called.

Bigger Flying Boats—Research on Aerodynamic Novelties—Variegated Wing Loadings—Duralumin Triumphant

By LESSITER C. MILBURN

Second Vice-president and Chief Engineer, Glenn L. Martin Co.

THE GENERAL TREND toward new ground during the coming year is indicated by the current interest in flying boats, amphibions, gliders and autogiros.

The increasing needs of the North-South American lines, and the Great Lakes and coast-to-islands projects, combined with the U. S. Navy's renewed interest in the flying boat problem, will bring about the more rapid and much needed development of American marine aircraft. In this field, as with the airplane, we have been the first to originate and the last to develop.

L. C. Milburn

The summer shore habit, now so common, has prepared an excellent field for the privately owned and "bus" type amphibion, which combines speed greater than the automobile with the freedom of call of the cruising motor boat. Its escape from traffic and the ready access to city centers (and all the large cities have water frontage), which it provides, will be more and more appreciated.

The feeling for art and sport in flying is always present to grace the more laborious struggle for speed and cargo capacity. This year is promising renewed interest in the glider and very low power plane. The progress of the last few years in aerodynamics and in construction may be expected to unite to produce gliders and soaring planes of unexpected qualities.

This year probably will see also further practical development of the autogiro, possibly to the extent of finding useful occupations for this thus-far vagrant member of the aerial family.

The reduction of parasite area, and the increase of operating serviceability, are to be more and more expressed in dollars, quantitatively, as the chemist would say, instead of qualitatively, as heretofore. The direct comparisons resulting from this definite yardstick will provide new incentive to produce planes which perform and continue to perform with low maintenance.

There is no definite limit to size, and some further effort may be expected for size as such. General progress in size will only be made as required for economic operation and greater pay-load, or greater distance. One would expect to see greater effort displayed to reduce the cost of large landplanes rather than to increase their size. Flying boat operators with less fixed investment, low ceiling barriers, and plenty of room, can operate larger aircraft more profitably.

This year will see further search to find the proper sphere of utility of slots, flaps, variable pitch propellers, variable camber, and other aerodynamical devices which have been presented to the industry in years past.

In addition to the current wing loadings of 8-12 lb. per sq.ft. for landplanes and 12-18 lb. per sq.ft. for larger flying boats, this year may see some indications of a return to former unit loadings of 6-8 lb. for private transportation and sport use.

Aspect ratio, offering an avenue of constant improvement, can be expected continually to increase, as rapidly as structural efficiency permits.

The conversion from wood to metal will be completed as rapidly as quantity production grows. Aluminum alloys have definite structural and manufacturing advantages over steel tube and sheet, and will continue to be used generally for planes up to 50,000 lb. gross weight.

The greatest improvement which I expect to see 1930 bring forth is in instruments and navigation. The recent Pacific coast disaster indicates how much handicapped air transport is without further development of means for safe operation in bad weather.

• • •

Evolution Along Standard Lines—Restricted Landing Speeds

By REX B. BEISEL

Vice-president and Chief Engineer, Spartan Aircraft Co.

THE GREATEST PROGRESS in design will be in perfection of detail both structural and aerodynamic. By that I mean a greater attention will be paid to simplicity, light weight, and maintenance, and in the case of aerodynamic detail to interference resistance and general cleanness of design. The goal as I see it is to approach the perfect airplane by refinement of conventional design rather than to hope for improved performance through a radical design departure.

R. B. Beisel

2. In my opinion there is no sound reason for responsible or experienced companies initiating machines larger than those already built. In other words, production of such types would not in my opinion be justified by probable sales.

3. I am not in favor of aerodynamic novelties or striking departures from accepted form and do not believe there will be any marked increase in their use. With proper and intelligent design it is possible to build a conventional

airplane considerably better than a great majority of the existing types. This procedure will be conducive to airplane sales, much more so than trick design.

4. I believe there is a tendency to swing to the cantilever type of wing especially on airplanes where top speed is the essential requirement. However, the type of wing structure whether braced or unbraced, monoplane or biplane, should be governed to a great extent by the type of and requirements of the particular airplane to be designed.

5. I believe a check has been reached on unit wing load through the new Department of Commerce regulation limiting landing speeds to 60 m.ph. I am in favor of limiting the landing speed and also in favor of keeping landing speeds down to somewhere near this figure both from the standpoint of safety and the effect on the performance of the airplane.

6. Aspect ratios will increase, i.e., the span loading will decrease.

7. The departure from wood to metal wing construction will and should be very gradual. Metal will not displace wood in the lower price class types until very large production is warranted which will not be in the next few years. Metal wing construction is more applicable and relatively cheaper on the large than on the small airplane and the fact that the percentage price differential between wood and metal wings on the large multi-motored airplane is small is conducive to metal construction. The real advantage of metal over wood construction is to my mind not apparent except under the influence of certain climatic conditions. As far as long life is concerned, there is little advantage of metal over wood inasmuch as there is little to be gained by designing an airplane to last ten years when it will become obsolete or be all or partially crashed after a month shorter period.

8. I believe metal construction, in this country at least, will continue to be predominatingly of duralumin, because of the experience and familiarity already attained with its use and fabrication in the airplane, availability of material, cost of construction, and the tendency in American manufacture to get away from "gingerbread" design, which is more or less general with alloy steel strip construction.

9. I see no reason for any marked change in landing gear construction. With greater use of the Oleo and brakes, the improvement in landing gear functioning has been so marked as not to require any great additional development. More and better landing fields also greatly influence the above. The use of "wide" treads seems to have been universally adopted along with the added use of brakes. Here again the width of tread, unless the landing gear is attached directly to the fuselage, is a function of the design of the airplane as a whole, i.e., the bimotored machine or the externally braced monoplane readily takes a wide gear with apparently no disadvantage in using same. I see no reason for strikingly modifying the landing gears of small planes to reduce the nosing over tendency. The effort to obtain good performance with low power requires a clean gear and I believe with proper design the tendency to nose over can be reduced to a minimum.

I am very much in favor of the liquid-cooled engine in the larger horsepowers, i.e., 500 hp. or over. Whether Prestone-cooled or not, I expect to see the liquid-cooled engine used more and more extensively. The use of geared propellers and a super-charger on the liquid-cooled engine will offset any advantage of the large air-cooled engine. With the necessity of using the N.A.C.A. or a similar cowl on the air-cooled engine to obtain performances comparable with the liquid-cooled engine, the additional weight and complication of installation, especially from the standpoint of engine and oil cooling, makes the air-cooled engine installation from the airplane designer's viewpoint much less attractive.

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Cantilever Wings and Lower Aspect Ratios—Giant Planes Improbable

By H. C. RICHARDSON
Director of Engineering, Allied Motor Industries, Inc.

THE GENERAL TREND of design appears to be toward multi-place cabin planes, with high or low wings. The principal effort will be to clean up aerodynamically, avoid all possible protruberances by either streamlining or retracting the landing gear. Cantilever wings of the monoplane type will gain in popularity.

H. C. Richardson

Very large planes have been projected and are even under construction. Perhaps this has reason in anticipation of future public interest, but appears premature and ambitious and hardly warranted by present public demand. Ten-place appears reasonable and should be popular. Twenty- to thirty-place possible of commercial success. Fifty- to one-hundred place reasonably possible of attainment with little chance of comercial success—and over one hundred more or less fantastic and visionary promotion at this time. Even larger planes are realizable but can hardly prove efficient without considerable research and development.

The result of the Guggenheim competition will undoubtedly advance the sentiment toward inherent stabilizing elements, and may produce some inventions equal or superior to those demonstrated in that contest. I look for greater progress in better proportioned controls and the avoidance of gadgets.

The increased performance demanded will undoubtedly lead to greater use of cantilever wings; the first step being the semi-cantilever, perhaps, with sesquiplanes.

The demand for performance will tend to stretch design loads to the upper limits permitted by the Department of Commerce—though this will be countered to some degree by the Guggenheim competition results.

The cantilever effort will probably result in a decreased aspect ratio.

Wood construction will principally remain in popular types and in new experimental designs which, if they obtain popularity, will be quickly translated to metal. However, there will be a price deterrent.

Duralumin will probably continue its sway. Too little has yet been accomplished in alloy steel strip construction in this country to expect much advance in that type.

Combination oleo and balloon tires will become more popular. Tandem wheels in larger planes may be expected. The big stroke oleo is partly defeated by Department of Commerce drop test requirements. Oleos need still further to study to eliminate peak loading.

Increased use of brakes and tail wheels will tend to force the main wheels forward, and require oleo tail

skids, or balloon wheels on tail skids. The wheel tail skid makes this less of a handicap than with the previous construction.

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More Variable-Lift Devices—Cantilever Wings—Better Landing Gears

By T. P. WRIGHT

Chief Engineer, Curtiss Aeroplane & Motor Co.

IN GENERAL, I feel that there will be continued activity on the part of designers towards the aerodynamic refinement of airplanes. I think this is more likely to be outstanding than structural improvement.

2. I believe the number of large planes initiated in the near future will be less than in the past similar period, because of the very high expense involved in the development of such projects, accompanied by the rather doubtful market for these ships, based on the showing so far made by air transport companies. However, I feel that this is only a temporary lull based on the immediate reaction from the present slump, and that eventually the sphere of usefulness of the airplane will lie more in the field of large transports than in any other. In all probability, however, in the near future no new very large ships will be developed.

T. P. Wright

3. I am quite certain that a very considerable use of the various means at hand for increasing lift by special auxiliary wings, etc., will take place during the next one to two years. It seems, too, based on definite information I have at hand, that this is one of the most fruitful sources of aerodynamic improvement and one which should be utilized to the utmost.

4. In all probability, during the next year there will continue to be a considerable number of externally-braced monoplane wing airplanes placed on the market and perhaps because of the smaller difficulties in design, there will be a preponderance of this type. However, I feel that there will be more internally-braced wings than heretofore and that there will be a definite trend towards this type which will eventually become predominant.

5. It is my belief that wing loadings will definitely increase, not accompanied by increased stalling speed, but rather due to the aerodynamic innovations introduced by such expedients as slots and flaps, decreased stalling speeds. In other words, I feel that there has been a definite check on increased stalling speeds and that during the next year the trend will be towards slightly slower speeds rather than higher.

6. I think there will be a trend to smaller aspect ratios as the larger aspect ratios are difficult to obtain with monoplane designs, particularly of the internally-braced type.

7. I feel that the trend will definitely continue towards all-metal construction, probably bringing to light new types of construction of various interesting forms. I believe wood spars will continue in use on ships of 3,000 lb. gross weight and less for a considerable period of time but that few ships of over 5,000 lb. gross weight, using wood spars, will be constructed hereafter.

8. I believe that undoubtedly interest in steel strip construction will become apparent within the next year or two, although I believe that duralumin will still predominate in metal construction for some time to come.

9. I believe that the oleo landing gear has come to stay, and that in general the stroke, or travel, will be increased. This tendency may be diminished somewhat by the combined use with the oleo gear of the Goodyear Musselman type (or similar type of other manufacture) tires. It is also my opinion that the tendency will be towards wider treads and that retractable landing gears will make their appearance on quite a number of designs. It is also probable that some light planes will be developed which have definite provision for prohibiting or lessening the tendency of nosing over, although I do not believe the next year will see much effort in this direction.

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Size Depends on Demand—Wood and Metal Remain in Balance—Trimming Parasite Resistance

By A. A. GASSNER

Chief Engineer, Fokker Aircraft Corp.

IT SEEMS TO US that the greatest progress in design during 1930 will be made in improving the aerodynamic characteristics of airplanes. It is not to be expected that revolutionary changes in wing section or fuselage shape will be attempted to obtain better efficiency for the complete airplane, but that the design will be refined to eliminate as far as possible all details which are creating turbulence in the flow of the air without creating a proportionate amount of lift. This can be achieved, for example, by making the landing gear retractable into wing or fuselage; by rounding off sharp corners of the fuselage; by eliminating or refining brace struts for wing and tail surfaces; by refining the engine cowling on air-cooled radial engines, for which purpose the N.A.C.A. cowling and the Townend ring have shown the way for future developments.

A. A. Gassner

2. The design of very large planes seems to be more an economic and financial problem than one of engineering, science or art. At the present time there seems to be no immediate need of landplanes of larger size than already built in this country. The further development of large-sized seaplanes, however, is needed for transatlantic service.

3. The introduction of aerodynamic novelties into commercial ships for the year 1930 is not very likely. The Cierva Autogiro and the slotted wing are both about ten years old and have made comparatively little headway. Any new and striking departure from accepted standards has to be developed both structurally and mechanically, which is usually more difficult than the aerodynamical perfecting of accepted standards. Commercial ships can only be sold in quantities when they give few service troubles and every new design has to be put through a process of experimentation before it is fit for production.

4. The cantilever wing has decided aerodynamic ad-

vantages over the braced wing, and the two designs appear to be surprisingly similar in weight. The final choice is made in considering production cost, as the tapered, cantilever wing is more expensive to build than a braced wing of uniform rib section. This speaks in opposition to the cantilever wing for ships in a class where low price is the chief consideration.

5. The unit wing loading for landplanes seems to have reached an upper limit with about 18 lb. per sq.ft. An increase of the maximum lift coefficient of the wing by increasing the mean aerodynamic camber would tend to decrease efficiency. As landing speeds have to be kept at 60 m.p.h. for single-engined, and 65 m.p.h. for multi-engined planes, a further increase of wing loading is not to be expected.

6. The average aspect ratio of the wing will probably remain as now, that is, between 6 and 7.5. An improvement in wing characteristics can be made, however, by increasing the taper as has been done on the Fokker "F-32," the Rohrbach "Romar" and Junkers "J-38."

7. Wood has always been, and still is, a very reliable material for primary and secondary structure of airplanes. Its advantages and disadvantages compared with metal construction balance about evenly and we should not expect rapid changes from today's picture as far as commercial planes are concerned.

8. I believe that duralumin will be used more extensively than strip steel. British airplane manufacturers probably felt inclined to develop the strip steel construction on account of the absence of aluminum deposits in the British Isles. The welded steel tube fuselage construction will probably continue to be used on most landplanes.

9. Landing gears will be built more generally with oleo-pneumatic or oleo-spring shock absorbers. As airports all over the country have been improved considerably, a shock absorber travel of 6 in. seems to be sufficient for medium-sized planes with not too high wing loading. The nosing over of planes equipped with brakes can be avoided by placing the landing gear far enough forward.

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Comfort and Convenience—Ample Reserves of Power

By H. A. HICKS
Aircraft Engineer, Ford Motor Co.

THE GENERAL TREND of airplane design in 1930 will be to fulfill the demands of 1929. For passenger work these demands were for more comfortable and economical transportation with greater speed and safety. As the novelty of air travel has passed to competition with established surface transportation, it is essential that the air passenger have accommodations and comforts equal to the Pullman passenger. The 1930 plane must be made more quiet by not only decreasing the sound at the source, but by its absorption within the cabin. Clear vision, more comfortable and vibration-absorbing chairs, restful interiors, provisions for tasty lunches, and adequate toilet facilities must be incorporated. Radio receiving sets installed as standard equipment will prove of valuable assistance to the pilot as well as passengers. In some large cabin planes the weight of materials installed specifically for passenger accommodations, and included in the empty weight of the plane, reaches the astounding figure of 8 per cent of the plane's gross weight. The introduction of refinements will demand a structural revision to yield a lower structural weight, using both sections of higher form factor and materials of higher specific strength/weight ratio.

The demand for higher cruising speed should be met, not by an increase in power plant size, but by increasing the propulsion efficiency by improved propeller design and more efficient power plant location; also by a reduction in overall plane drag effected by lower resistance engine cowling, landing gear wheel streamline, more efficient fairing between units such as wing-to-fuselage, engine cowling-to-fuselage, and landing wheel-to-landing gear.

More safety will attend passenger transportation as the use of multi-engined planes become universal. Certainly the successful passenger planes of 1930 will be of this type, providing they have been designed to yield real performance and control with one or more power units "cut."

The added safety in multi-engined operation maintains with the ability of the plane to continue flight with one or more of its power units out of operation. It is necessary then, that the airplane be controllable and have sufficient ceiling for operation over the airway route with at least one of its engines "cut" in order to be superior to the single-engine plane. Reference to a topographical map of the United States shows that east of the Mississippi a plane with an absolute ceiling with full load of less than 5,000 ft. with one engine "cut" should not be used, while west of the Mississippi a ceiling of 8,000 ft. is necessary. Tri-motor planes with engine units of about equal power are the most economical because this installation yields the most satisfactory fractional engine performance.

The trend of passenger transports has been toward larger planes with the result that the gross loads and geometric dimensions have steadily increased. This has been caused by a demand from some operators for greater capacities, in the belief that the large plane would reduce operating costs. The 30- to 40-passenger transport provides a cabin of larger size yielding more satisfactory passenger accommodations with a given minimum crew. As night flying is exploited, the larger plane with a day capacity of from 30 to 40 and sleeping accommodations for 15 to 20 passengers provides our nearest approach to railway competition. A plane of this size, however, is more costly to build and does not lend itself to quantity production.

The full cantilever wing construction will continue to gain in favor as cruising speeds increase. It presents an aerodynamic and structural cleanliness which manifests itself in performance and appearance. By using a thin airfoil section at the tip, tapering both in plan and thickness to a high lift section at the fuselage, a high speed, ceiling, and rate of climb is obtained, with a relatively low landing speed. An internally braced wing demands a more careful design study in order to equal the structural weight of the externally braced wing. It is particularly suited to all-metal wings. The use of the thick section necessary for structural strength largely eliminates the necessity of novelties such as slots and flaps which further increase the duties of the pilot.

The unit wing loading during the next year should tend to increase in passenger transports. The unit wing loading of an airplane depends on many other factors than gross weight and wing area. In multi-engine planes

where low power loadings usually are used it is possible to use a higher wing loading. The proper proportion of power to wing loading with a given airfoil is one which can best be determined by experience. The engine locations, airfoil used, exactness of airfoil form, landing gear type, relation of wing to fuselage, type of brakes, all have a direct bearing on airplane performance and should be considered when discussing unit wing loading. In multi-engine planes the wing loading will probably reach 18. This is necessary to reduce structural weight, increase the high speed, and place the planes on a more economical basis, as they increase in size. As airway routes become more highly developed, airports more numerous, and multi-engined planes with highly developed power brakes and softer landing gears in universal use, it will be possible to land passengers at the higher speeds created by increased wing loadings.

Aspect ratios for internally braced monoplanes will remain approximately constant between 7 and 8, with 7¾ as an efficient average. Below this figure the aerodynamic efficiency of the wing falls off rapidly and above 8 the increase in efficiency is obtained with too great a structural weight. The plan form of this type of wing will increase in taper for increased rigidity.

The all-metal airplane is the ultimate in plane construction for all types. The trend will first be noticed in the larger planes where, because of greater geometric dimensions, the advantages of metal construction are more obvious. Metal is the basic medium of our modern automotive industry. Railway cars, auto bodies, building and bridge structures originally made in wood are now made in metal. Metal is manufactured and treated by exact processes; it is capable of exact analysis, is homogeneous, and its strength can be relied on within a few per cent. It is non-hygroscopic and wings made from metal have a definite aerodynamic value independent of temperature and humidity. The life of a properly designed metal plane is at least five years, or 3,000 flying hours. Metal construction calls for more accurate detail and fabrication, more expensive tooling, but is better suited for quantity production and yields a more refined and substantial product than wood. Metal construction in the small planes will be largely of duralumin but the larger plane offers a possibility of using materials of widely varying specific gravity. In the present duralumin metal plane the control surfaces and wing tips have high margins of safety because it is not practical to use this material less than 0.010 in. in thickness owing to the danger of distorting or crushing the sections during fabrication and service. Steel for these parts of 0.0035 in. for the same weight is even less satisfactory as it also lacks local stiffness. Obviously the most economical material for these parts would be magnesium alloy, the lightest of commercial metals, which could be used as thin as 0.012 in., properly protected, at a saving in weight of 20 per cent over duralumin. Duralumin finds its use for sections from approximately 0.010 in. to 0.120 in. in thickness. Where heavier stock in duralumin is required it would be more economical to use steel because of its higher specific weight/strength ratio, especially in compression. The main advantage in the use of steel over duralumin is in the fabrication of the joints, using smaller gusset plates, fewer rivets, saving in weight as well as fabricating cost.

The composite structure of steel and duralumin will not be successfully used because of their difference in expansion and modulus of elasticity. However, it will be a structural advantage to have one section of a wing spar of duralumin and an adjacent inboard section of alloy steel. The ideal large plane is one in which the geometric extremities of the wings and fuselage and control surfaces are of properly protected magnesium alloy, with the intermediate and adjacent sections of the wing and fuselage of duralumin and the middle portion of the fuselage and wing root of alloy steel.

The design of landing gears will vary considerably depending upon the class of plane. The small training and sport plane will undoubtedly make use of low-pressure tires, using these without shock absorbing members. The greater tire supporting area will be of value when operating from small fields where soft surface conditions may exist. The large transport planes operating from airports will use the present type of tire to reduce drag, but will increase considerably the shock absorber travel. As planes become larger and landing speeds increase, the precision with which a landing can be made decreases. This will necessitate landing gear shock absorber travels as great as 24 in. It is anticipated that wider tread landing gears will be more in favor to facilitate landing and taxiing. With suitable engine location, and the advent of more powerful brakes, the possibility of nosing over will be properly designed for to actually allow the plane to bear down on a forward skid in the event of an emergency landing where severe braking conditions are demanded.

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Better Economy by Cleanness of Design— A Chance for Stainless Steel in Airplanes

By C. T. PORTER
Chief Engineer, Keystone Aircraft Corp.

THE PRESENT PROBLEM apparently is to carry more pounds for less money, and this should lead to improvement in cleanness of design. The horsepower per pound of payload must be decreased. I expect to see retractable landing gears, and power plants housed in the wing.

C. T. Porter

2. A capacity of 40 passengers seems to me to be a reasonable economic limit at the present time. The problem is to find use for our present transport airplanes before experimenting with sizes outside our engineering experience.

3. The use of novelties such as those on the Curtiss "Tanager" should possibly increase the popularity of sport flying. The value of their use on transport airplanes is yet to be demonstrated.

4. I believe large ships will gradually develop into flying wings with the power plants inside the wing, hence the cantilever principle will apply. On small ships I look for a continuation of the braced monoplane type.

5. Wing loading should increase on large ships, with increase of effective power-operated brakes. On small ships it will probably stay nearly at present values.

6. No radical change in aspect ratio would seem to be indicated.

7. There seems to be no reason to replace wood by metal where the former meets structural requirements with less weight and cost. Large ships will naturally have complete metal structures, but I expect to see the wing

beams of small ships continue to be made of wood until production quantities justify metal stampings.

8. I look to see increase in use of high-strength alloy steels, especially "Stainless Steel." Its high strength makes its strength weight ratio equal to or better than duralumin and its ability to resist corrosion is superior.

9. In the case of large airplanes, I look for retractable landing gears with longer travel and very powerful brakes, this to go with increase of landing speed. In the case of light airplanes I expect landing gears to be able to take a pancake landing, especially in the case of airplanes with slots and flaps.

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Radicalism May Be Worth While— Cantilever Wings Most Economical

By H. V. THADEN

Gen'l Manager, Pittsburgh Metal Airplane Co.

IT SEEMS TO ME that the greatest improvements are going to have to come in aerodynamics and cleanness of design. Structurally there will unquestionably be some improvement, but I believe it will require a prodigious amount of effort to make any worthwhile lowering in structural weight from today's conventional. I am rather confident that metal construction will undoubtedly result in a distinct improvement from the weight standpoint but even so it is hard to visualize more than a ten to fifteen per cent decrease in weight.

H. V. Thaden

2. Speaking as one with no experience in the larger planes, I can simply voice the opinion that I believe the larger planes are economically justifiable and I expect to see considerable development in these larger sizes.

3. Although I personally have been rather conservative in departing from conventional aerodynamic characteristics, I am beginning to be of the opinion that it is only by some departure from our present methods that we are going to get any real improvements. The ideas of the slotted wing and the removal of airfoil boundary layer are extremely interesting, but so far I haven't had the courage to use them in any of my designs.

4. My views on cantilever vs. externally braced wing trusses are becoming fairly set. It is my opinion, after having passed through all the stages in design from the biplane truss to the semi-cantilever and finally to the full cantilever, that the latter is the most practical. Its relative structural simplicity as well as its higher aerodynamic efficiency are distinct points in its favor. Of course I am assuming a rigid cover of some sort. Practically all my work has been with some form of rigid metal covering which acts as a stressed structural member as well as a covering. Recent results in a monocoque type of wing which we are developing confirms this opinion.

5. From all my own observations it seems to me that wing loadings are going to continue to rise, but probably at a slower rate. It would seem that with the better fields and the greater number of fields that speeds up around 60–70 m.p.h. could be justified. I know that I have tended towards faster and faster landings in my personal flying. Of course, the lower landing speeds would be desirable but the question is how to get them and still keep any kind of decent performance figures.

7. I should say emphatically yes to your question as to whether metal construction is to show further progress in the immediate future. Some of the most recent results of the Army and others besides ourselves indicate that a practical type of metal-covered wing structure is not far off. Just how long it would take the manufacturers of conventional airplanes to appreciate and change over their systems is something I don't know.

8. Biased as I more or less am because of my experience in a light alloy field, I naturally am wedded to that kind of material. I have found that the impracticability of handling the necessarily thin gages of steel in the shop has retarded the use of this material. Even the thinner gages of duralumin which would be three times as thick as steel of the same strength, have a definite minimum gage from a shop standpoint. Of course all my thoughts along this subject are predicated on an all-metal construction including the cover, and I don't quite see how alloy steel could successfully compete in this type of construction.

9. I anticipate the use of larger shock absorber travel and generally softer landing gear with wider treads on any of the conventional bi-planes or high-wing monoplanes. I have been advocating the low-wing ship for some time, and in this connection I anticipate the use of streamline "pants type" landing gear for the low-wing. Whether the mentality of the average pilot will enable him to use a retractable type of landing gear, I don't know. I rather question, however, whether this type, with its additional controls will become truly popular on any except the racing planes.

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Designers Must Watch the Operators— Larger and Faster Planes— Better Engine Cowlings

By GERARD VULTEE

Chief Engineer, Lockheed Aircraft Corp.

COMMENTING ON the probable trend of aeronautical engineering during the coming year, it is my opinion that we are in a period in which, primarily, the airplane must justfy its use upon an economic basis.

Assuming this statement to be correct, it naturally follows that the manufacturer must adapt his product to the current needs of the operator. While, naturally, all efforts should always be made to increase the safety of aircraft in every way possible, the statistics of the last year have shown that with present equipment the safety of air travel compares very favorably with other established means of transportation, so that it appears that the problem of selling the public on the safety of aviation in general is more an educational than an engineering one.

At the present time it is perhaps more important that the operators be furnished airplanes which will enable them to carry at a profit such passengers or cargo as will be attracted by their advertising and educational campaigns.

The type of airplane needed, of course, depends upon the operating conditions on each particular line. Several of the larger airlines have recently put into effect drastic

reductions in rates. (In some instances so great as to make the fare by air lower than the Pullman fare between the same points.) These reductions have been made for the purpose of increasing the volume of passenger traffic through price appeal, and thus reducing the unit operating cost per passenger. Assuming the expected volume of traffic is obtained, additional saving in costs may be effected by the use of larger planes, instead of merely running more planes of the same size. Thus, it may be predicted that the coming year will see a number of new designs in sizes,—perhaps as large as 50-passenger capacity. It is natural to expect that such development work will be carried on mainly by the larger manufacturers.

Considerable progress in the development of very high speed planes of smaller type may be expected during the coming year. The need for such equipment exists with mail lines, and with lines which must cover a long route in one day, in order to avoid night flying with passengers. Naturally such through lines would not secure the volume of passengers carried by the shorter lines operating between large adjacent cities. Their rates would be higher in proportion as would be also their operating expenses. Planes for such lines will be developed to carry from four perhaps ten passengers, and have cruising speeds in excess of 150 m.p.h. In the case of such long-distance routes, the slight increase in operating cost would be well offset by the time saving element, which is one of the prime requisites for air transportation.

As to the engineering features which will be in evidence in the design of such planes, it is only possible for an engineer to give his personal views. The question of cantilever wing structure versus external bracing is one which necessarily must be considered as depending upon the operational requirements for each particular case. It would seem reasonable to assume, however, that the trend should be toward cantilever construction because of the saving in head resistance which can be accomplished through the elimination of external bracing.

As larger spans are reached, it will be necessary to resort to wings which employ deeper sections at the roots, and which are tapered more strongly than is customary in current designs. It may even be advantageous to increase the amount of taper to the extent that the lift distribution along the span no longer conforms with the optimum elliptical distribution. Naturally, such procedure should decrease the aerodynamic efficiency of the wing slightly, but it is believed that sufficient structural advantages can be secured so that the saving in weight would more than pay for such a loss.

The use of retractable landing gear in designs which are laid out to accommodate them makes it possible to increase the landing angle appreciably. With such an increase in landing angle (combined, of course, with the use of an air foil having a flat topped lift curve and controls which are effective in the region of stall) it will be possible to reduce the roll on landing considerably without the excessive use of brakes; or, assuming that the required roll of the plane be kept the same, the wing area may be reduced and thus the cruising speed of the plane increased without decreasing the safety of the plane.

It is the writer's personal opinion that the development by manufacturers of complete cowling for radial engines has been somewhat neglected. The advantages to be obtained by the use of such cowling on planes properly designed to incorporate it, seem sufficiently attractive to justify the expense of additional research and development by the individual manufacturer.

No Radical Changes—Steady Tendency Toward Metal—Steel Looks Promising

By H. RAWDON

Chief Engineer, Travel Air Co.

I DO NOT LOOK FORWARD to any radical change or development in the design and the construction of airplanes during the year of 1930. Gradual refinement in details, structures and aerodynamic forms is contemplated.

It is unlikely that slotted wings will greatly increase in favor this year due to an apparent divergence of opinion as to their merits. The recent success of the slotted wing airplanes entered in the Guggenheim Safe Plane competition may, however, give an impetus towards their further adoption.

H. Rawdon

Though plans for larger and more powerful airplanes than now exist will probably be made, it does not appear to me that the present demand justifies such ambitious construction schemes. Possibly it will be the principle, however, of making the demand fit the case rather than the case fit the demand. I cannot pretend to be a prophet in this respect.

Undoubtedly the wing bracing will gradually evolve to simpler and fewer external members, in the direction of incorporating the truss internally within the wing. The unit wing loading will probably increase slightly in its average figure, though, at present, it appears to be about as high as is practical. The value of the unit wing loading is a function of number, distribution, size and quality of airports as well as the aerodynamical properties of the airplane. Personally, I favor a reasonable figure for the unit wing loading. The trend of practice regarding wing aspect ratio will probably remain about the same as was used the past year.

It appears logical, and the general design trend is indicative of a sure evolution towards metal structure displacing that of wood. No revolution in design can be contemplated. The stumbling block seems to be the lack of efficient spar design that can be economically fabricated.

The probable trend will be the gradual substitution of metal parts for wood, such as ribs, etc. The next few years will probably see greater development of the drawn strip steel structural sections. Duralumin would seem a preferable stressed covering material owing to its low relative density. The low relative density is important, since the stiffness of the covering varies as the cube of its thickness and for the same weight a given surface would be of stiffer construction made of duralumin than if it were made of steel.

There is a growing tendency to provide landing gears with shock absorbers of the oleo-type and with larger energy absorbing capacities. This is necessitated by the increased wing loadings and resulting higher landing speeds.

Inasmuch as it is the purpose of the shock absorber to absorb shock, the larger its energy absorption capacity the more satisfactory it would prove in this respect. I expect to see this year some development in the oleo shock absorbers of greater shock absorption capacities.

Aerodynamic Progress by Mass Production—Higher Landing Speeds

By KENNETH M. RONAN

Chief Engineer, Stinson Aircraft Co.

I BELIEVE THAT no revolutionary change in aerodynamic or structural details will be made this year. I feel that the structural and aerodynamic qualities of the airplane are to a considerable extent very closely related; that is, that we will be able to improve the aerodynamic cleanliness by building airplanes in such quantities that we can change the structure to suit aerodynamic refinement more than we do at present. I believe that the greatest progress is going to be made in structural refinement so that parts and assemblies which are now generally hand-made will be almost entirely machine-made. This, of course, is a question of more production. We are now at a stage in design knowledge where we could go ahead with structural changes so that a great deal of the body of the airplane and wings could be made from stampings. I feel that the number of ships being sold is practically the only retarding factor in this development of a lower priced and improved airplane.

With regard to the design of larger planes, my ideas are mainly guesses. I do feel that considerably larger planes will be built and that, again, structural design is the determining factor. We cannot go much further toward increasing the size of ships with our present types of structure, because of the relatively large increase of dead weight with the increase of size. One solution appears to be the use of a higher landing speed and I feel that this, to a limited extent, is allowable and a reasonably safe practice as the size increases.

With regard to the question of aerodynamic novelties: I feel that such appliances as slotted wings, floating ailerons, etc., will only be used in ships designed to meet special conditions. In my opinion, for ships designed for the general public, the smaller the number of such contrivances, the safer the ship is likely to be. If slow landing speed is desired, I feel that it can be secured more practically by an increase of wing area, and if we must maintain or increase the top speed on the design it can be done more cheaply by the use of power. I believe our speed will be increased more by the use of considerably lower power loadings than by the use of trick appliances.

Regarding the question of cantilever or externally braced wings, I think the question will be solved from the standpoint of cost. If the production is such that stampings will be used almost entirely, the cantilever wing will probably cost no more than the externally braced wing.

I believe that the wing loading will continue to rise. This, I think, will be determined to a considerable extent by the availability of landing fields. The average pilot could set a plane down which lands considerably faster than the present airplane if the field were smooth and sufficiently large.

Regarding aspect ratios, I believe they will remain about as they are at present.

Metal will replace wood for structural parts as soon as production warrants the use of tooling for it. I think that steel will allow several types of production methods which may replace to a great extent the use of duralumin in the primary structure.

With regard to landing gear, I feel that we will have greater landing gear shock absorber travel and large low-pressure tires. I believe that treads will be wider than those in general use at present. Landing gears can be put farther ahead of the center of gravity if the power is increased to help lift the tail in getting off. This will prevent nosing over tendencies somewhat prevalent on the smaller planes.

I believe that the biggest trend is going to be the use of a great deal more power. Ships will also be designed for more comfort, ease of handling and other items which the general public is beginning to demand.

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Refinements in Slots and Flaps—Gradual Increases in Size

By F. S. HUBBARD

Chief Engineer, Berliner-Joyce Aircraft Co.

THE GENERAL TREND of airplane design at the present time and for future development is toward increased efficiency. This means improved aerodynamic shapes and cleanliness of design, improved and lighter structural shapes with a trend to lighter metal construction. These phases are more or less dependent on each other in order to obtain more efficient airplanes.

In the development of large planes any increase in size is dependent upon improvement in design and size of the power plants. Large planes should also be multi-motored, especially for passenger carrying, and should sustain flight with only a portion of their motors functioning to insure safety of operation. I believe as passenger and freight carrying increases the size of the planes will progress likewise and we shall see larger planes in the future, both in landplanes and seaplanes.

The slotted wing, flap and floating aileron are rapidly being developed and their success was exemplified in the Curtiss "Tanager" which recently won the Guggenheim prize. Their ability to decrease the landing speed and improve the control at stall has been proven and I believe with a little more refinement they will be adaptable especially to commercial aircraft.

In regard to whether cantilever or externally braced wing arrangements will predominate, I believe each has its place. In monoplane design, the cantilever wing will more and more come to the front as the metal wing is developed. However, for biplanes, which will also be used due to their smaller span and compactness, the externally braced arrangement will predominate.

As to wing loading, it may increase slightly with the use of slots and flaps. However, we are beginning to reach our limit in this respect, especially for landplanes where low landing speeds are desirable. Higher wing loadings with higher landing speeds for seaplanes are permissible, due to their larger landing facilities.

Aspect ratio will not increase materially any more than it has in the last few years. This is due to the fact that cantilever monoplanes are restricted to certain aspect ratios. Externally braced biplanes which are normally allowed a greater aspect ratio become unwieldy, require too much external bracing, and take up unnecessary hangar room as ratios are increased. Also the gain in efficiency is small after a certain aspect ratio is reached and any further gain is offset by structural and other considerations.

Metal construction is rapidly coming to the fore due to the difficulties in obtaining good wood and also the uncertainties of this material. Metal lends itself to pro-

duction and will be looked upon more favorably as production increases. I believe both duralumin and alloy steels have their place in design. With the improvement in alloy steels such as stainless steel and the proper use of heat treating, steel will be used more and more, especially on large airplanes where fittings and joints can be more readily handled in steel.

Designers of landing gears are attempting at all times to improve this part of the airplane, especially in taking shock loads. This requires better mediums for taking these loads and usually a larger shock absorber travel. The tread is dependent to some extent on the span of the airplane, and I do not believe will be materially altered in percentage of tread to span. In the design of landing gears for light planes, it will not take a special type of landing gear, but the arrangement will have to be modified to prevent nosing over. I think the greatest field for thought in the future in this phase of design will be to improve landing gear for amphibions, as this type will become more popular as times goes on.

In conclusion, the airplane of the future in my opinion, is going to be a gradual refinement of the present-day airplane rather than any revolutionary type. This will be brought about by increased efficiency in design, more efficient and reliable power plants, decreased landing speeds due to devices like slots and flaps, increase in controllability of the airplane, especially at low speeds, and increase of efficiency in taking off and getting into smaller fields.

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From the Foremost American Authority on European Developments

By JOHN JAY IDE
Technical Assistant in Europe, N.A.C.A.

I HAVE RECEIVED your questionnaire on the probable trend of American technical development in the near future. Before taking up in order the various points you mention, a few general observations may be made.

I believe that greater attention will be devoted to multi-engined transport airplanes by those companies competent to create large units. The existing stock of small single-engined cabin aircraft would appear to militate against continued intensive production of this type. The recent drastic cuts in the long-distance air line fares, whether wise or not from the economic standpoint, have at least had the effect of increasing the proportion of actual to potential pay load, and thus will result in orders for large units for replacements and additions to the existing fleets. The flying public is now accustomed to the comparatively roomy accommodations available in the large liners, and would resent being asked to fly in small machines on long stages. New types of large transport monoplanes will be developed, having three or four engines mounted above the wing and all driving tractor screws.

It is hoped that intensive efforts ill be made to develop a really seaworthy multi-engined flying boat of about 15 tons total weight, of reasonably clean aerodynamic design and requiring the minimum amount of attention. Notwithstanding their weight, water-tight bulkheads should be incorporated in the hull; the floor should likewise be watertight so that a damaged bottom will not sink the ship. The engines should be mounted high enough to prevent damage to the propellers by water. Advantage should be taken of the great experience acquired by the Naval Aircraft Factory at Philadelphia, in the art of building flying boats, experience which would no doubt be placed at the disposal of manufacturers seriously undertaking the development of civil seaplanes.

In answer to the second question, I certainly do not expect to see any larger machine than the Do.X built during 1930, either at home or in Europe, although Dr. Dornier has prepared designs for a larger type.

The reply to the third point, as to whether there will be an increase in America in the rise of aerodynamic novelties, such as slotted wings, would appear to depend upon legal rather than technical considerations. Personally, I have always been a strong believer in the efficacy of the automatic slot in providing control beyond the normal stalling angle. Due to the action of Air Commodore Chamier, former Director of Technical Development, the automatic slot has been made standard on all service aircraft in the Royal Air Force except those of the single-seater pursuit class. It has likewise been sold to the Swedish Government and is being tested in France, Italy, Poland, etc.

While hesitating to venture a prophesy on the question of cantilever versus braced structures, I believe that the present ratio will remain approximately constant, each manufacturer continuing to use the type of structure characteristic of his productions in the past.

The unit wing loading will probably continue to rise as for some years past. The wisdom of this trend, as far as land machines are concerned, is very questionable, as it is impossible to be always within a reasonably short distance of a field allowing a high speed landing.

Due to structural rather than aerodynamic considerations, it seems probable that aspect ratios will remain constant on the average and will not increase.

It is to be expected that metal construction will continue to make progress and that wooden spars, still used primarily on the ground of economy, will yield to metal when satisfactory sections are developed.

Notwithstanding the excellent results obtained in England with alloy steel strip, I do not believe that it will be adopted widely in America on account of the comparatively high cost of production and the degree of skill required.

The success of the American adaptations of the British oleo landing gears has been most striking and continued development is certain. Such gears combined with air wheels should make bad landings almost inexcusable. Treads should be made as wide as compatible with airplane structures.

In closing I may emphasize the vital importance of our engine manufacturers quickly developing reduction gears and superchargers sufficiently rugged to withstand hard service. Such equipment will be essential if reasonable pay loads are to be carried over the mountain passes of North and South America. It would also appear that liquid cooled engines have been too long neglected, and that serious effort should be made to improve our position in this respect. The recent work of the Army Air Corps at Wright Field in chemical cooling, while undertaken primarily for service use, has interesting possibilities commercially.

Further contributions to this symposium will appear in next week's issue.

THE *Engine Builders* LOOK AT 1930

A Symposium of Engine Design Tendencies by Power Plant Engineers and Manufacturers

OUR collective forecast of 1930, prepared by the personnel of the industry itself and of the interested government departments and educational institutions, is brought to a closure by presenting a symposium upon power plant trends. The general introductory remarks might be much the same as those affecting the general trend in aeronautical business (page 290) and that in airplane design (page 331). In engine questionnaire the specific inquiries put were:

CONTRIBUTORS TO THIS SYMPOSIUM

George J. Mead, vice-pres., Pratt & Whitney Aircraft Co. 342
P. B. Taylor, acting chief engineer, Wright Aeronautical Corp. 343
Robert Insley, vice-pres., Continental Aircraft Engine Co. 344
Henry M. Mullinix, former chief of Powerplant Section, Navy Bureau of Aeronautics 344
John H. Geisse, chief engineer, Comet Engine Corp. 345
C. Fayette Taylor, Professor of Aeronautical Engineering, M.I.T. 346
Lieut. Comdr. C. G. McCord, U.S.N., Naval Aircraft Factory 347
L. M. Woolson, aeronautical engineer, Packard Motor Car Co. 347
N. N. Tilley, chief engineer, Kinner Aeroplane & Motor Corp. 348

1. Is the liquid-cooled engine likely to regain substantial favor during the coming year, or do you consider that the general trend towards air-cooling will continue?

2. Do you expect air-cooled engines to continue predominantly radial, or do you anticipate a decided trend towards the development of in-line V and X forms?

3. What are the most important improvements in engine performance that you anticipate in the near future? Do you expect substantial further increase in reliability or in life between overhauls? Do you think that substantial reductions in weight per horsepower can be anticipated?

4. Do you expect that it will be possible to make further increases in compression ratio without change of basic fuel?

5. Are you in favor of a marked improvement in the standard fuel as governed by specifications, increasing its uniformity and its anti-detonant qualities, with the object of permitting increases in compression ratio and brake mean effective pressure and of decreasing weight and frontal area?

6. What is your opinion of the probable early future of the compression-ignition type of engine (whether or not true Diesel cycle) in aircraft powerplants.

7. Do you look forward to marked innovations in cylinder arrangements, such as the introduction of double-row radial or X engines?

8. What is the prospect for the use of materials outside the ordinary present range of commercial practice, such as magnesium for crankcases and cylinder heads, or of new manufacturing processes, such as the forging of cylinder heads of duralumin?

9. Are you satisfied with the present type of engine mounting and the ways in which it is applied?

10. Are any marked simplifications or improve-

ments in accessory installation and in "plumbing" to be looked for?

11. Does the present relation between the responsibilities of the airplane engine designers satisfy you, or do you believe that there should and will be a trend towards the building of unit power plant sections, with the engine designer providing for standard mountings, cowlings, and accessory locations?

UPON these topics there is, of course, a natural difference of opinion, and in few cases, if any, was the unanimity complete. There is, however, a general agreement that the liquid-cooled engine will make good progress, especially in the largest sizes, but that, on the other hand, the air-cooled radial will continue in the leading position in the field. Few of our contributors ventured a hope for any further substantial reduction in weight per horsepower, expecting progress rather in reliability and durability, and few look forward to any material increase in compression ratio without improvement in fuel.

The one point upon which unanimity is most nearly achieved is the fifth in the questionnaire. Almost without exception those who replied expressed themselves as strongly favoring better fuel, even at higher cost.

Upon the Diesel engine there is wide variety of belief, but with conservatism bordering upon scepticism predominating. Few of the designers offering comment could see any bright future for the use of forged aluminum alloy cylinder heads, but many expressed the strongest hope for magnesium alloy castings in crankcases and elsewhere. Several entertained the hope of decided improvement in the present method of mounting engines, and quite a majority of those expressing definite opinions hold that the engine designers should take more responsibility for the mounting and for the general installation and arrangement of the power plant section of the airplane. On the whole, the engine designers, like those concerned with the airplane structure will not confess to looking for any radical novelties.

In closing the introduction and turning the floor over to those who have been good enough to make contributions to this symposium, we cannot refrain from pointing with pride, as we have felt inclined to do in the two previous instances also, to the extraordinarily broad representation of the industry that is presented here. With hardly an exception, the chief engineers of the important American engine manufacturing companies are present and speaking, — fully and frankly. To them, as to those who replied to our other questionnaires, of which the results have been set forth on the earlier pages of the present issue, very hearty appreciation is due from ourselves and from our readers.

Better Accessibility—Improved Standard Fuels—Skeptical on the Diesel

By GEORGE J. MEAD

Vice-president and Technical Director, Pratt & Whitney Aircraft Co.

IT IS DOUBTFUL whether we can expect any startling improvements in engine design without some very definite assistance from the metallurgist and the chemist. Without their help there will naturally be a steady improvement of details resulting in better and better powerplants. On the other hand, measured by weight per horse power or fuel consumption there will be relatively little gain. As far as weight is concerned, it may even be desirable to increase commercial powerplant weights in order to reduce the fatigue value of certain parts.

George J. Mead

1. Liquid-cooled engines of over 700 hp. may prove of value for military purposes. It is believed that air-cooled powerplants give superior military performance in smaller units. The growth of the liquid-cooling development is dependent upon a definite reduction in drag as a result of smaller radiators than are necessary with water-cooling. In view of the high temperatures, it is no longer possible to water-cool the oil, so that it now becomes a question of whether the combined water and oil-cooled radiators will have appreciably less drag than the single water-cooled radiator hitherto required. To obtain the best results with liquid-cooling it is necessary to design for it and the subsequent higher operating temperatures. For commercial purposes I believe air-cooling will continue to be used because of the greater pay-load that can be carried as well as the greater reliability which is inherent in this type of engine.

2. The radial form of air-cooled engine is likely to predominate because it gives the simplest and lightest powerplant. It may be necessary in very large power units to go to another type. Unfortunately, the weight of other air-cooled types is so much greater that it will then become a question whether it is desirable to use air-cooling or not.

3. The most important improvements in engine performance in the near future should be directed towards reduction of operating costs. To this end greater accessibility will be provided, so that overhauls may be made with the minimum number of man-hours. In the same way, periodic inspection will be facilitated by improved design. The greatest problem to be solved is that of material fatigue. This necessitates the replacement of certain parts—fortunately minor—several times during the life of the powerplant. Fuel and oil consumptions are quite reasonable and form only a small per cent of the operating cost per mile. For this reason, I doubt whether there is as much need for improvement in this direction as in others. Further reduction in weight per horse power will be very slow. It may even be worth while to increase the weight of commercial powerplants to obtain greater durability.

4. Compression ratios cannot be raised appreciably without the use of special fuels. As a matter of fact, the tendency has been to use ratios that were too high for the existing fuels.

5. A great gain in engine performance can be made by improved fuels. As a matter of service record it has been proven time and again that it is cheaper to operate

on the very best fuel. Better fuels will make possible higher power output, somewhat less weight per horse power and better fuel consumption depending largely upon the anti-knock quality of the fuel.

6. The future of the Diesel type of aircraft engine is most uncertain at the present time. Compared with the present Otto cycle engine, the Diesel powerplant weight, including fuel for a long-distance flight, would apparently be less. It is doubtful whether there would be any saving if the orthodox engine were operated on a more suitable fuel. Inherently the Diesel engine must stand higher pressures and therefore is heavier per horse power. A partial solution of this difficulty is two-cycle operation, which seems almost a requirement if the Diesel cycle is to be considered at all for aircraft. For any normal commercial operation in the United States there seems to be little or no improvement to be had from the Diesel. After all, it is not entirely a question of fuel cost but pay-loads carried for a given horse power. It seemed at one time as though the Diesel was particularly desirable for Zeppelin work. Now that blau gas has been introduced, which obviates the need of valving precious lifting gas, the Diesel cycle seems much less interesting for this purpose. There may be a reduction in fire hazard and radio interference with the Diesel cycle, but it is doubtful whether it will be used in view of these considerations alone.

7. Almost all the possible kinds of cylinder arrangement have been already tried, so that I do not look forward to any innovations in this line. Naturally, as the power required of each unit increases, the more simple types of cylinder arrangement will have to give way to others, since there is a more or less definite limit to the size of the individual cylinder.

8. Aside from fuel developments, the greatest improvement in engine performance will come through the use of more suitable materials. At the present time, further weight saving is not as essential to commercial aviation as reduction of fatigue. The savings in weight under 1½ lb./hp. that might be made would have relatively little effect on the operating costs of a commercial company. At the present time, the lighter the material, the poorer its fatigue characteristics seem to be, especially at operating temperatures.

9. The mounting of radial engines is about as simple as can be devised. On the other hand, there may be a trend towards complete removable power units with at least lubricating system and controls. However, such an arrangement has not been found worth while in the automobile field and I doubt whether the weight involved will make it desirable for aviation.

10. It is doubtful whether there will be any further simplifications in accessories or their installation. As a matter of fact, the accessory requirements of commercial aviation are likely to be more and more numerous. As a result, the powerplant is very likely to become more complicated rather than simplified.

11. The satisfactory operation of a relatively complicated group of mechanical units always depends upon cooperation between the designers of the various units and a mutual understanding of each other's problems. Fortunately, the industry has reached a point where the plane designer appreciates the problems of the engine manufacturer and heeds in most cases his advice. This situation has contributed quite considerably to the excellent performance of our commercial aircraft during the past year.

More Air-Cooled Vees—Better Mountings, and More Coherent Installation—Diesels Sometime, But Not Yet

By P. B. TAYLOR
Acting Chief Engineer, Wright Aeronautical Corp.

THE LIQUID-COOLED engine is still in the experimental stage, and will in all probability not emerge before the end of this year. Air-cooled engines will continue in popularity for all service with the possible exception of high performance military ships. I believe the air-cooled "V" engine possesses most of the advantages of liquid-cooled engines with the added advantage of simple installation without radiator or plumbing.

2. I believe there will be a decided trend toward in-line, "V" and "X" forms for large size engines, which will be carried to some extent into the smaller sizes.

3. I believe a substantial reduction in weight per horsepower of aircraft engines will be accomplished in the near future. Increase in reliability and life between overhauls is also essential for the success of aviation. The two developments are opposed to a certain extent but improvements along both lines will be accomplished.

4. It will be possible to slightly increase the compression ratio without changing the basic fuel. This will be accomplished by better cylinder cooling.

5. I am strongly in favor of the use and wide distribution of better fuel as governed by specifications. This alone will permit decrease in weight per horsepower and increase in reliability of aircraft engines.

6. I believe the compression ignition engine is probably the type which will eventually supersede the present electric ignition units. This development will come slowly and will not be a solid injection engine.

7. I look forward to marked innovation in cylinder arrangement, such as the double row radial, the "X" engine and other more radical forms.

8. The use of magnesium is already practical but expensive. I believe the possibility of increasing the horsepower in a given engine is a far more satisfactory method of reducing specific weight than the use of special light alloys. If the ultimate is desired from a cylinder, the use of forged duralumin heads is undoubtedly necessary. This process is also expensive and will probably be confined to military and racing types for the present.

9. I am not at all satisfied with engine mounting structure and its method of application. The engine is at present used to complete the mounting structure. I am of the opinion that the correct method of engine mounting is a three-point support on the engine, which will be so designed that the engine will be able to take the mounting strains through the crankcase. This type of mount does not permit of a misalignment as three points are completely universal.

10. I believe the oil tank and oil cooling device may become a part of the engine supplied by the manufacturer. This will result in a simplification of plumbing and an increase in reliability. Accessories will continue to be the bugbear of the engine designer.

11. The engine manufacturer will eventually supply sufficient cowling to cover the engine unit. He may also supply the exhaust manifold and oil tank. His design must be sufficiently universal to be adapted to a large fuselage or a small nacelle. This is a serious limitation and prevents the use of universal cowling carried behind

the engine cylinders on a radial engine. An air-cooled "V" is a decided improvement in this respect as the cowling which contributes to engine cooling can be supplied entirely by the engine manufacturer without interfering with installation.

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Relation Between Engine Form and Fuselage Form—Better Fuels Not to be Counted On

By ROBERT INSLEY

Vice-president, Continental Aircraft Engine Co.

THE LIQUID-COOLED engine will supplement but not supplant the air-cooled type in the next year or two. The development of the high temperature liquid-cooled engine presents problems the solution of which will cost time and money. Liquid cooling will prove valuable in wing installations, high speed airplanes and in types of engines such as geared engines and the two strike Diesel in which air cooling cannot handle the heat to be dissipated. But the development of line and Vee type air-cooled engines to avoid the excessive drag of the large radial type will have a considerable influence on the popularity of the liquid-cooled type. The air-cooled engine, moreover, has distinct advantages for the purely commercial operator who is not interested in the last possible mile per hour, which will extend its popularity in spite of the high speed characteristics of the liquid-cooled type. The liquid-cooled engine will play an increasingly important part but cannot be expected to do more than high speed specialty acts for several months to come.

2. The unqualified success of several in-line and Vee type air-cooled engines has demonstrated the practicability of these types. The present excitement about the liquid-cooled engine, whose chief raison d'être is its low drag, promises a definite field of usefulness for a type of engine which offers reduced drag without the additional weight of the liquid cooling system. But it must be remembered that the two principal advantages of the line or Vee type air-cooled engine over the radial type, reduced drag and reduced vibration, vary greatly in importance with the types of installation and size of engine. For instance, what would be the benefits of a line or Vee engine installation on a round-bellied craft like the Lockheed or Fleetster? Or a radial engine installation in a Burnelli? Will an honest balancing of advantages over defects justify the existence of a line engine of 100 hp. or less in comparison with a high grade radial engine? Can anyone present physical proof that the small radial engine (of say 400 lb. or less) is of necessity a rougher engine than the corresponding line engine, or less efficient aerodynamically when cowled to the same degree of cooling? The line and Vee air-cooled engines will find soundest justification in the larger sizes.

3. The most troublesome portion of the present aircraft engine is the valve gear, from crankcase to valve seat. I look for definite improvements there, both in valve gear type and in durability of the present valve gear. Engine life will increase as a result both of improved construction and of more experienced handling by operators and service men. No marked improvement in efficiency or substantial weight reductions can be expected this year.

4. It is possible but not desirable to increase compression ratio with the basic fuel now in use. The advantages to be gained do not measure up to the grief which lies in that direction.

5. I see no prospect of marked improvement in efficiency or reduction in frontal area due to the general commercial use of higher grade fuels. The fuel companies have made remarkable progress in the manufacture and distribution of high grade aviation gasoline and the Army and Navy have attained astonishing engine performance on special fuels, but there are too many hazards in that direction to expect much commercial progress there next year.

6. The compression ignition engine still has a long mile to travel. I shall be surprised to see any great inroads into explosion engine territory in the next four years, and then only by the two-stroke cycle Diesel.

7. There is at present a decided trend toward greater power and consequently probably to larger number of cylinders. This trend may be interrupted temporarily by the realization that more frequent flights rather than larger airplanes is the immediate need of air transportation. Therefore, while W or X engines are likely to be needed later, they probably will not be numerous this year. I do not expect to see any new double-row radials.

8. Some of the new materials likely to be useful this year are: magnesium castings and forgings replacing aluminum castings and forgings; Aluminum Company No. 132, or similar low expansion aluminum alloys; nickel iron (high expansion iron) in connection with aluminum pistons and cylinder parts; Nitralloy for shafts, cylinder barrels, etc.; forged duralumin pistons; high lead bronze for bearings, bushings, guides; Carbaloy for production tools.

9, 10, 11. The present engine mounting is about all that can be expected in the coming year. Unit power plant sections, including all power plant equipment except controls and fuel tanks, and replaceable easily as units, are likely to be developed later. Simplification of plumbing, chiefly fuel lines, is urgently needed. Engine cowling is now generally furnished by engine builders. Gradual standardization of accessory mountings and locations is to be expected.

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Better Accessories—Better Reliability, Better Co-operation of Airplane and Engine Designer

By HENRY M. MULLINNIX

Former Chief of Powerplant Section, Navy Bureau of Aeronautics

AIR COOLING of aircraft engines is a permanent feature of design. In Naval aircraft, besides the reduced vulnerability of air-cooled engines, the special limitations on airplane design are such that liquid-cooled engines are out of the question. There are definite fields for the liquid-cooled power plants, however, among which are: (a) aircraft for special purposes, such as racing, etc., and (b) installations demanding individual units of high power.

It seems that practical limits of air-cooled cylinder sizes have been reached. Larger cylinders may be employed at reduced brake mean effective pressures, or engines of greater power may be assembled with more cylinders, but when engines of greater power are required it seems better to resort to liquid-cooled cylinders of larger sizes.

In further development of small air-cooled types it is probable that in-line or Vee engines may gain in favor. There is little to recommend these types in comparison with the radials for the intermediate sizes, but the X and V arrangements offer some advantages in twelve- or sixteen-cylinder units.

The greatest improvements in engine performance anticipated in the near future are refinement in details and improvements in accessories. Accessories susceptible of development or improvement include fuel pumps and strainers, oil coolers, spark plugs, wiring, radio shielding, power plant instruments, carburetors, and air cleaners. Cowling improvements already indicated should be adapted and applied.

Reliability will be improved, but not life between overhauls. The 400-hr. period now generally accepted is controlled chiefly by piston ring wear and valve conditions. Higher speeds and heavier loads which may be required in future aircraft operations may force some reduction in time between overhauls.

Minor savings in power plant weights are possible at some increase in cost of manufacture. Reductions of weight may be attained by design modifications, but considerable savings do not seem possible without reduction of safety factors unless through employment of improved materials. Better ferrous alloys and commercial availability of lighter non-ferrous materials, such as magnesium or beryllium alloys, as well as better technique in employing such materials, should permit material savings in weight per horsepower.

Material increases in present design practice as regards compression ratios while employing the present basic fuels do not seem feasible. Even though fuels of better anti-knock characteristics were available, the permissible increases in compression ratios would entail operating difficulties out of proportion to the advantages derived. Increases of compression ratio and brake mean effective pressures to attain decreased weight and frontal area involve sacrifices of flexibility and dependability which restrict these expedients to special purposes. There is a distinct field for employment of "boosted" engines, i.e., engines supercharged above atmospheric pressures at sea level, in high altitude and other specialized types of aircraft. For these engines special fuels are desirable.

There is definite need for improving fuels, as governed by specifications, with a view particularly to insuring uniformity of anti-detonant and other qualities. No marked increase in the anti-knock quality of the better fuels is required for ordinary engines, but all fuels should be brought up to the standard set by the better grades.

There is not any immediate prospect of employment on a large scale of the compression-ignition type of engine in aircraft practice. The advantages of compression-ignition, including reduced fire hazard, more efficient cycle, elimination of electrical apparatus and hence of radio interference, elimination of carburetion problems, and other benefits less evident, would seem to outweigh the difficulties encountered in metering and injecting minute quantities of fuel at the proper instant. Although the Diesel cycle engine suffers upon comparison with the Otto cycle engine in flexibility there seems to be a definite field for employment of Diesels and a gradual extension of their use may be predicted.

The present type of engine mounting is fairly satisfactory although there is room for standardization in the matter of mounting of different engines, and location of the piping, fittings, controls, and other incidentals. There is great need for improvement in accessory installations, particularly carburetor air heaters, air cleaners, and miscellaneous items. Some rearrangements of accessories may be made by the engine designers but any changes involving so many considerations must be gradual. "Plumbing" may be improved by standardization of fittings, and such expedients as employment of short lengths of flexible metallic tubing where great flexibility or resistance to vibration is needed. A great deal of research effort has been expended upon development of fuel pumps, valves, cocks, and incidental fittings, but further improvements are needed.

It has been suggested that engine builders should produce complete power plants, including standard mountings, cowlings, oil tanks and other accessories. There seems to be need for more information regarding cylinder barrel operating temperatures, permissible oil temperature ranges, and engine cowling designs, including shutters and other controlling devices. These are problems for engine builders, since faulty installation may impair engine performance, or life, or both. The connection between general airplane design and cowling design, oil tank arrangement and other power plant details is so close, however, that it seems best to leave final details to aircraft designers and builders as heretofore but to make additional information available to them. Building of interchangeable unit power plant sections for particular models of aircraft is desirable and in air transport and other extensive activities readily detachable and interchangeable unit power plants should be of material assistance to maintenance engineers.

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Liquid-Cooled Engines Supreme for High Powers—Diesel Development Vital—Get Better Fuel and Pay the Price

By JOHN H. GEISSE
Chief Engineer, Comet Engine Corp.

THE LIQUID-COOLED engine will undoubtedly regain substantial favor within the next two years. In the higher power units it will entirely supplant direct air-cooled engines. In the medium and low power classes it will probably share the business with the direct air-cooled radial engine.

John H Geisse

2. The air-cooled engines will undoubtedly continue to be predominantly radial. I expect the direct cooled in-line V and X engines to be entirely supplanted by liquid cooled engines of the same form.

3. I do not look forward to any very substantial reductions in weight per horse power and would not be at all surprised at increases in this figure. I do expect substantial increases in length between overhauls, and reductions in fuel consumption. There will be a gradual increase in the appreciation of the relative importance of durability and low fuel consumption as compared to low specific weight.

4. It is possible to increase compression ratios with fuels at present available, at the expense of power output

per cubic inch displacement. Because of the importance of fuel consumption I expect a gradual trend toward the use of lower mean effective pressures and higher compression ratios.

5. I am very much in favor of securing better fuels for aviation engines. Because of the cost of carrying the gasoline in the plane a very much more substantial increase in cost per gallon for anti-detonating characteristics is warranted in aviation gasolines than is warranted in automobile gasolines. Just as soon as such a gasoline is made generally available the airplane engine manufacturers can provide engines which will not only give increased plane performance but will decrease substantially the cost per mile per pound of pay load.

6. The true Diesel cycle, by which I mean a cycle in which the fuel is burned at constant pressure, will undoubtedly play an important part in the future development of aviation. In so far as engines are concerned, it is the most important advance which can be foreseen at the present time. The time which will be required for this development depends entirely upon the amount of funds made available for development work. I am firmly convinced that the Diesel engine in the future will not only maintain the advantages of Diesel engines as they are now known, but will also be lighter in pounds per horsepower than the present Otto engines.

7. I do not expect any innovations in cylinder arrangements. Neither the double-row radial nor the X engines can be considered as innovations as they have already been used. However, I see no immediate future for the double-row radial, but I do see a future for X engines with liquid cooling.

8. As in years past, there undoubtedly will be improvements in materials. Increased use of magnesium may be expected when the airplane operator sufficiently appreciates the value of weight saving to pay the premium required.

9. I do not see any particular advantage in the so-called ring mounting as such. A four point mounting would be infinitely superior. However, any mounting arrangement which decreases accessibility, however simple it may be, is not warranted.

10. I rather expect considerable improvements in accessory installation. Provision of a through drive on accessories would simplify the engine designer's problems. As examples of this, provision for driving the tachometer from the end of the magneto would in many cases eliminate some gearing, as would also the design of a generator which could be used in the tower shaft for driving the cam shaft.

11. I have always contended that the engine manufacturer should provide the engine sections back to the fire wall.

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Magnesium Crankcases—Anti-knock Fuels—Better "Plumbing"?

By C. FAYETTE TAYLOR

Professor of Aeronautical Engineering, Massachusetts Institute of Technology

IT IS ALWAYS DANGEROUS to make predictions for the future, but I will endeavor to answer your questions as best I can.

1. I believe that the liquid-cooled engine will always retain a useful place in aeronautical application, particularly for military and for lighter-than-air work.

2. I believe that air-cooled engines will continue to be predominantly radial for the next year or so, although the proportion of in-line and V type engines will show a decided increase.

3. I do not expect any radical improvements in engine performance in the near future. There should be a gradual but slow trend toward increased reliability and reduced weight per horse power.

4. I do not understand what is meant by "basic" fuel. It is perfectly possible to improve the anti-detonation qualities of gasoline substantially, in which case compression ratios can be increased.

5. I am certainly in favor of a reasonable anti-detonation requirement in our fuel specifications for aviation gasoline. If the best aviation gasoline now available were taken as a standard it would allow some increase in present compression ratios, which are limited by the worst fuel which they are likely to encounter at the present time.

6. I believe that the compression ignition engine will continue to remain in the experimental stage during the year 1930. I should expect its first really practical installation to be in lighter-than-air craft.

7. Double-row radial engines are already with us, notably the Curtiss Challenger, the Brownback, the Anzani, and in England, the Armstrong Siddley. I do not expect that 1930 will show any very great increase in the number of such engines, or will find the X engine in general use.

8. Magnesium alloys are in fairly general use for crankcases in Europe, and I should hope that this development would reach the United States in the near future. Magnesium is not suitable for cylinder heads, and I do not think that American manufacturers will put up with the excessive machining expenses of forged cylinder heads to any great extent.

9. I am never satisfied with any engineering structure, since improvement is always possible. This applies to engine mountings as well as everything else.

10. I have been hoping for real improvements in "plumbing" for a good many years. At the present time this hope still seems as forlorn as ever.

11. There is already a decided trend toward the supplying by the engine manufacturers of most of the engine auxiliaries, including such items as the exhaust system and part of the cowling.

In general, I look forward to the introduction of a definite antiknock value in fuel specifications to be one of the most important steps to be expected within the near future. The development of the compression ignition engine is being pushed by so many competent laboratories and individuals that I expect rather rapid progress along this line. Another very important development, which should be completed within a reasonable time, is the National Advisory Committee research on the proper relation of the propeller with respect to an airplane wing and outboard engine installation. This may have an important effect on the trend of engine design. Further improvement in cowling for radial engines seems perfectly possible, and may reasonably be expected if the National Advisory Committee continues its researches along this line in their large wind tunnel.

Another important development which may be looked forward to is more definite information on the value of propeller reduction gearing for various types of airplanes. The answer to this question, of course, might have a very distinct effect on engine design.

Air or Liquid Cooling?—Electrical Fuel Pumps

By LIEUT. COMDR. C. G. McCORD, U.S.N.
Naval Aircraft Factory

IT SEEMS PROBABLE that much work will be done during the current year along the lines of high temperature liquid cooling, following the trend of Army and Navy tests which show a considerably increased fuel economy and a low percentage of jacket heat rejection due to its application. It will require more than a year's time, however, to develop production engines on this principle.

A box score of the relative advantages of the average of several air-cooled engines as compared to some Prestone cooled engines is appended as being of possible interest.

	A	L
Specific Dry Weight	...	1
Total Weight of Power Plant	1	...
Aerodynamic Drag	1	...
Number of Parts	1	...
Ease of Mounting and Cowling	1	...
Efficiency of Mixture Distribution	1	...
Cooling Required by Use of Rich Mixture	...	1
Avoids Plumbing Difficulties	1	...
Thermal Efficiency	...	1
Mechanical Efficiency	Same	
Volumetric Efficiency	...	1
Average Time between Overhauls	1	...
Accessibility for Overhaul	1	...
Equal Cylinder Liner Expansion	...	1
Range of Speed and Flexibility	...	1
Limitation of Cylinder Size	...	1
Limitation of Compression Ratio	...	1

2. While the present system of carburetion of fuel is in use, the superior distribution of mixture in the radial engine, added to its cooling, cowling and installation advantages will probably keep it in popular favor, continuing to lead the Vee, in-line or X types of cylinder arrangement as a predominating type. At least one new barrel type engine is reported as being on test with some degree of success.

3. Improvements anticipated are along the lines of application of solid fuel injection, compression ignition, and use of higher cylinder temperatures. Some hope may be held out for the development of L or T head arrangements and for a radical change in head design that will permit a safe increase in horsepower per cylinder in air-cooled engines above the present limits. Life between overhauls increases with the slow and steady process of refinement and development of materials, and no radical advance is to be expected. The same remark applies to specific weight.

4. Improvements in fuel during the past two years indicate a possibility of going to higher compression ratios with undoped hydrocarbon fuels by use of the heavier fuels in the normal boiling range alone or blended with the lighter paraffins, both types tending to suppress detonation, but probably requiring special fuel tanks for extreme applications.

5. Higher standard and uniform fuel for aircraft governed by carefully drawn specifications is earnestly recommended. Test methods will have to be standardized.

6. The use of compression ignition, in due time, appears to be assured; but increase in weights above those of present Otto cycle engines, to insure reliability, must be expected.

7. It is conceivable that the desirability of mounting of engines in wings, using wing surface radiators, may bring about development of a horizontal opposed type of cylinder arrangement.

8. No change of materials of construction is anticipated, although refinement of methods for working what we have continues.

9. Present types of engine mounting, excepting most types of tandem mounting of air-cooled engines so far devised, appear to be satisfactory.

10. Removal of fuel pumps from the engines and substitution of electrical pumps in large ship installations appears logical. Further advances in the matter of tubing material are also indicated. A trend toward complexity of plumbing is shown by the number of cleaners, heaters, and filters of various descriptions now on the market.

11. The present system of design should be continued inasmuch as power plants are far from the point of standardization and cowling is still in the experimental stage.

The last year brought forth very little in the nature of radical change or improvement in Naval aviation power plants, but did bring an encouraging improvement in government contract fuels.

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Diesel is Coming—Special Fuels May Be Too Expensive—Radials Still Hold the Field

By L. M. WOOLSON
Aeronautical Engineer, Packard Motor Car Co.

MY OWN REACTIONS to the very interesting questions which you have propounded are as follows:

1. Engineering sentiment is far from being crystallized on this question of engine cooling. In the larger size engines there is no doubt that water-cooling or liquid-cooling is here to stay for some time. In this connection it is my opinion that troubles with water-cooled engines due to plumbing have been grossly exaggerated. On the other hand, in the smaller powered engines there is no question that direct air-cooling is preferable.

L. M. Woolson

2. Barring unforeseen developments I would expect the radial air-cooled engine to maintain its leadership.

3. I am convinced that greater reliability, decrease in cost and increased ease of maintenance are far more important questions than any minor reductions in weight per horsepower.

4. I believe that gasoline aircraft engines today are using as high compression ratios as it is feasible to use, fuel limitations being considered.

5. Any improvements in fuels which can be brought about without perceptible increase in cost are highly desirable, but except for military purposes I do not believe that any substantial increase in cost is warranted to obtain the results mentioned.

6. There is no question that the compression ignition aircraft engine will in time offer severe competition to the gasoline engine. There are, however, many basic problems to be solved for the solution of which there exists no precedent.

7. There is no reason to believe that we have exhausted

all the possibilities in our search for the ideal form of aircraft engine. It will probably be several years before the best all-around type will be arrived at. Even in the automobile industry after a quarter of a century of intensive experimental work one still finds wide differences between various makes of powerplants.

8. There is every reason to believe that the metallurgist will contribute enormously to the improvement of aircraft engines. However, the suitability of materials for aircraft engines can only be ascertained by long endurance tests at rated output so that a great deal of experimentation is required in this field.

9. I do not look for much improvement along these lines.

10. This is a matter for each manufacturer to work out for his particular installation. There is no substitute for considerable operating experience as a means of arriving at these improvements.

11. It would appear that each installation will have to be considered on its own merits and while certain features of various installations might be common to all there are bound to be others which will vary considerably with various types of planes.

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Still Lower Weights—Improved Engine Mounts Desired—No Radical Changes in Materials Likely

By N. N. TILLEY
Chief Engineer, Kinner Airplane & Motor Corp.

I BELIEVE LIQUID-COOLED engines of the Prestone type will increase in favor for military ships, but that air cooling for commercial engines will become more universal

2. Development of in-line engines. In-line, air-cooled engines may decrease in popularity, due to their inherently higher weight than other cylinder arrangements. V and X forms will appear for high powers for military use, and may be initiated for commercial operation. The radial engine will probably predominate, due to the ease of cylinder cooling and light weight of the engine, especially where fuselage size is above engine diameter.

N. N. Tilley

3. The weight per horsepower of aircraft engines will continue to decrease, due to decrease of weight per cubic inch for displacement, as well as higher rotative speeds. It is also to be expected that further increases in reliability, as well as life between overhauls, will be obtained. It is believed that substantial reductions in weight per horsepower can be anticipated, since commercial engines are between 2 and 3 lb. per horsepower and there are standard type military engines of 1 to 1½ lb. per horsepower, and racing engines (Schneider Cup) have been down to ¾ lb. per horsepower.

4. Not for aircraft engines, except for possibility of more thorough knowledge of mechanics of combustion, which would probably not amount to more than ½ to 1 compression ratio higher than present.

5. Yes.

6. Considerable development of the compression ignition type of engine for aircraft will be required before it is commonly available. It is believed that the weight per horsepower must be equal to, or less than, that of the present type engines, in order to interest the public, since rapid take-off, rate of climb and speed are desired, rather than low fuel consumption or high mileage. Most flights are of few hours' duration. It is believed that flights must be of over five or six hours duration in order to show any advantage of Diesel engines (with low fuel consumption) if appreciably heavier than present engines. Also the difference between Otto cycle and Diesel becomes slight as the compression ratios come closer together.

7. It is probable that there will be development of X, Hexagon and Octagon arrangements of air-cooled engines for high power. I cannot tell at this time who will start this for commercial operations.

8. It is probable that improved foundry practice to insure soundness of material, freedom from flaws, as well as increased resistance to corrosion, will make magnesium alloys more interesting. Due to its low conductivity compared with aluminum, it is probable that magnesium will not be suitable for cylinder heads of air-cooled engines, unless the design is such that the temperatures are unusually low. At the temperatures at which cylinder heads operate, the added physical properties of forgings will be lost. It is probable that the complexity of such units is not suitable for forging. However, there will be increased use of aluminum forgings for other parts of the engine. Some advance has been made in permanent mould casting, although there are many difficulties to insure freedom from shrinks and unsoundness.

9. Engine mounts for radial engines are simple. However, airplane manufacturers are apt to use structures which are incomplete for getting adequate, or rather, suitable, torsional stiffness, so that there is no resonance with the engine. While rubber mounts aid, they are not the whole answer. Little attention has been directed to proper proportions between polar moment of inertia of the engine and stiffness of airplane structure between engine and wing, to avoid resonance with torque variation, or other sources of vibration, of the engine.

10. Improvements in "plumbing" are being continually sought both by elimination of the plumbing and by improvement in material and fittings.

11. There is some trend toward having the engine manufacturer supply the complete power-plant section. So far, this has included supply of exhaust system by the engine manufacturer, whereas formerly this was left mostly to the airplane designer. It is always necessary for the engine manufacturer to check cowling of air-cooled engines for cooling requirements to insure adequate cooling of the air-cooled engine, which may result in engine manufacturers supplying such cowling. While commonly the oil tanks are outside the engine, there have been a number of instances where they have been incorporated in the engine. The fuel system is still partly on the engine and partly off. Some manufacturers get more of the fuel system built onto the engine than others. The addition to the engine of double voltage generator to eliminate the dynamotor set simplifies the radio sending apparatus. While I know of no engines in this country which supply the mount, it has been done in Europe.

Further contributions to this symposium will appear in AVIATION *next week.*

GENERAL NEWS

HERBERT F. POWELL, *News Editor*

HIGH POINTS in the NEWS

▶ *The highest point.* St. Louis is host to the International Aircraft Show, Aeronautical Chamber of Commerce Class A exposition for 1930.

▶ *For search and research.* Fund of $1,321,000 reported by House Committee on Appropriations for National Advisory Committee for Aeronautics during fiscal year 1931. This is an increase of $28,800 over the '30 appropriation. Projects: completion of wind tunnel suitable for full-sized planes, 2,000 ft. seaplane channel, and new hangar.

▶ *A financial union.* National Aviation Corp. and Aeronautical Industries, Inc., both air investment firms, will band with National acquiring control of Aero. Basis: three shares of National for four of Aero.

▶ *Four years of details.* Such is desired by Senator Bratton, who now introduces bill asking air accident reports in full since March, 1926.

▶ *Want new Guard plane.* Study under way of seven designs submitted for construction of Coast Guard craft capable of withstanding heavy seas and of performing long flights over water. Decision now awaited by competitors.

▶ *In the meantime.* Statement by Secretary of War indicates but little progress in the settlement of differences between Army and Navy Departments concerning which service shall control the Coast Guard air forces.

Airports and Airlines

▶ *The first A-1-A.* Initial rating goes to Pontiac, Mich., airport, as Aero Branch begins listing fields with serial numbers. Applications are acted on in the order received.

▶ *A fine record.* P.A.A. reports, 2,986,000 mi. flown in 1929 with 98 per cent of its scheduled trips completed and 91.43 per cent completed on time. Figures include Pan American Grace and Mexican Aviation Co. systems. Increase over '28: 1,936,176 mi.

Foreign

▶ *Germany feels slump.* Reichstag directs The Transport Minister to select only a few of the most successful aeronautical plants as recipients of the now decreased government subsidy. Plane builders named: Junkers, Dornier, Heinkel, and Bayerische Flugzeugwerke. Engine manufacturers: Bayerische Motoren-Werke, Junkers, and Siemens.

Invite Governors to Show

ST. LOUIS (MO.)—Invitations to the International Aircraft Show have been issued by the St. Louis Chamber of Commerce to eleven governors, and Thursday, Feb. 20, has been set aside as "Governors' Day." The Chamber offers to provide aerial transportation to this city. Those invited are: Governors Caulfield, of Missouri; Emerson, of Illinois; Leslie, of Indiana; Cooper, of Ohio; Parnell, of Arkansas; Johnston, of Oklahoma; Moody, of Texas; Reed, of Kansas; Sampson, of Kentucky; Horton, of Tennessee; and Hammill, of Iowa.

New Rubber Developed For Cabin Insulation Use

AKRON (OHIO)—A new sponge rubber, which, among other things is said to be suitable for insulating airplane cabins against sound and heat, has been perfected by Glenn H. Willis, of Akron, said to have invented the original rubber sponge years ago. One of the chief features of the new material is that it is only one-half as heavy as the sponge rubber heretofore used and it is also more durable, being composed almost wholly of pure rubber. Air cells of any size can be produced in it.

The new rubber has been named "Belozel." This comes from the words "bellows cell," descriptive of the material structure. Willis has been working for nearly 20 yr. in perfecting his invention. Options for manufacture of Belozel have been obtained by two large rubber companies and it probably will be available on the market soon.

Willis is known in the rubber world as an authority on sponge rubber.

Deer and Turkeys Fed From Airplane

HARRISBURG (PA.)—It is believed many deer and wild turkeys in the mountainous sections of Cumberland County, Pennsylvania, owe their lives to a passing airplane—a plane which dropped 300 lb. of corn and apples in passing. The act of kindness was performed by Harry H. Gibb, a game protector, on behalf of the State Game Commission, which recently issued an appeal to feed the animals, now in danger of starvation due to extreme winter conditions.

House Reports N.A.C.A. Budget

Calls for $1,321,000 in 1931, $28,800 Increase Over 1930

WASHINGTON (D. C.)—On Feb. 5, the House Committee on Appropriations reported a bill which recommended the estimate of $1,321,000 proposed for the 1931 budget of the National Advisory Committee for Aeronautics. This is an increase of $28,800 over the 1930 figure of $1,292,200.

The appropriation bill states that a sum not to exceed $375,000 can be used for the completion of the full-size wind tunnel while $60,000 is mentioned for use in construction of a new hangar. Salaries of enlarged field and departmental forces will absorb part of the increase.

Plans, developments, and history of the N.A.C.A. were outlined at a hearing before the sub-committee of the House Committee for Appropriations on Jan. 14, by Dr. Joseph C. Ames, chairman of the National Advisory Committee for Aeronautics. He told of the laboratory at Langley Field, the office of aeronautical intelligence established in 1918, and the information and many reports issued by the Washington office—this last named activity having shown an increase of 50 per cent last year over 1928.

Tells of Channel and Tunnel

Structures at Langley Field include a research laboratory building, an atmospheric wind tunnel, a variable-density wind tunnel, a dynamometer laboratory building, and a propeller research tunnel. Dr. Ames pointed out the needs of a new hangar in line with other improvements being made by the Army at the Langley base. The N.A.C.A. owns two planes, but several more are in use there.

The speaker also told of the new seaplane channel to be built this year which will be 2,000 ft. long and is to be used for investigating the characteristics of seaplane boats and floats. Another project to be started soon is the full-size wind tunnel for the testing of full-size planes, in working out, among other problems, the control of planes at low speed. (A recent report states that the contract for the channel has been let to the W. P. Rose Co., of Goldsboro, S. C., while all bids for the wind tunnel, on the other hand, were rejected and changes made in the specification.)

Mention was made of the fact that information gathered by the N.A.C.A. was proving of increasing value to plane manufacturers as well as providing

(Concluded on Next Page)

Equip Lindbergh's Plane With Demountable Top

COLONEL LINDBERGH, SEATED in his Lockheed Sirius, shown as it appears with the detachable cabin-forming covering recently developed as protection against the elements. A non-shatterable, transparent composition is used in the device, which can be easily removed when the weather is fair.

House Reports Budget For N.A.C.A.

(*Concluded from page* 349)

government sources with important data. Many aeronautical designs and inventions are handled by the committee as an act of Congress approved July 2, 1926, and amended March 3, 1927, stated that the N.A.C.A. should pass upon the merits of all such developments. Reports are then made to the aeronautical patents and design board which consists of the Assistant Secretaries for Aeronautics of the Departments of War, Navy, and Commerce.

Among the problems considered by committee, stated the speaker, are causes of airplane accidents, the cause of airplane spins, the study of structural strength of planes under different air pressure conditions, the problem of reducing head resistance of craft, and the most suitable place for the location of the power plants in craft carrying more than one engine.

The propeller research tunnel where a large wing has been mounted and an engine in a nacelle, containing a propeller, is being placed in different positions, is furnishing information on the engine-placing question, stated the chairman. During his report, Dr. Ames illustrated several of his points with various small-scale models and discussed in detail their workings.

Present Membership

At the present time, the membership of the National Advisory Committee for Aeronautics is as follows: Joseph S. Ames, Ph.D., chairman; president of Johns Hopkins University, Baltimore, Md.; David W. Taylor, D. Eng., vice-chairman, Washington, D. C.; Charles G. Abbot, Sc.D., secretary Smithsonian Institution, Washington, D. C.; George K. Burgess, Sc.D., director Bureau of Standards, Washington, D. C.; William F. Durand, Ph.D., professor emeritus of mechanical engineering, Stanford University, California; James E. Fechet, major general, United States Army, Chief of Air Corps, War Department, Washington, D. C.; Benjamin D. Foulois, brigadier general, United States Army, chief of materiel division, Air Corps, Wright Field, Dayton, Ohio; Harry F. Guggenheim, M.A., president of Daniel Guggenheim Fund for the Promotion of Aeronautics, New York City; William P. MacCracken, Jr., Ph.B., New York City; Charles F. Marvin, M.E., Chief United States Weather Bureau, Washington, D. C.; William A. Moffett, Rear Admiral, United States Navy, Chief Bureau of Aeronautics, Navy Department, Washington, D. C.; S. W. Stratton, Sc.D., president Massachusetts Institute of Technology, Cambridge, Mass.; John H. Towers, commander, United States Navy, Assistant Chief, Bureau of Aeronautics, Navy Department, Washington, D. C.; Edward P. Warner, M.S., editor of AVIATION, New York City; and Orville Wright, Sc.D., Dayton, Ohio.

D. & N. Acquires Robey Firm

DETROIT (MICH.)—Dixie and Northern Air Lines, of Detroit, organized here in August, 1927, has absorbed the Robey Manufacturing Co., builders of a new sport monoplane known as the Robey "Speed-Aire," powered with a Szekely, and will manufacture that plane, it was announced here recently. General C. W. Harrah, veteran Detroit financier and aircraft enthusiast, is president of Dixie and Northern; Alec Imlay, Detroit business man, treasurer; and Syd A. Erwin, attorney, secretary, and counsel. Directors include Frank D. McKay, state treasurer of Michigan; Gaylord W. Norton, Detroit realty man; and Capt. H. M. Tunis.

Appoint Show Photographer

ST. LOUIS (MO.)—Wings Photo Service of St. Louis, operated by Phil Silverson, has been appointed official photographer for the International Aircraft Exposition of the Aeronautical Chamber of Commerce, Feb. 15-23.

Coast Force Control Question Still Unsettled

WASHINGTON (D. C.)—No final settlement of the differences existing between the Army and Navy as to which department of defense shall have jurisdiction over coastal air forces has been reached, it was indicated in a recent statement by the Secretary of War. Secretary Hurley called attention to the fact that the Army has been in charge of coast defense operations for 150 years and the War Department has no intention of relinquishing its control over this part of the nation's defense.

Meanwhile, it is learned that Naval officials are adopting an interpretation of their responsibilities that would afford them control over all navigation, whether marine or aeronautical. A troublesome question has also arisen in connection with the naval air shore stations. Members of the House Committee in charge of departmental reorganization believe that the best method of solving the problem of air defense would be to create an air corps independent of both Army and Navy.

In this connection, Representative Williamson, of South Dakota, chairman of the committee on expenditures in executive departments, is making an attempt to have transferred to his committee a bill proposing the creation of an independent air corps. This bill at present is on the calendar of the military affairs committee. Mr. Williamson believes, however, that the measure should properly be considered by his committee since it is the one vested with authority to carry out the administration's program for bringing about a more logical grouping of the departments.

Three Mohawk Pintos to Tour

MINNEAPOLIS (MINN.)—An extensive demonstration tour will be made through the southwest by A. S. Koch, vice-president and general manager of Mohawk Aircraft Corp., at the conclusion of the International Aircraft Exposition in St. Louis. Mr. Koch plans to have three new Pinto planes participate in the tour, which will require a month to complete. Stops will be made at principal cities in Missouri, Kansas, Texas, Oklahoma, New Mexico, Arizona, and California. The Mohawk company will have two planes on exhibition at the St. Louis show, one at the exposition and the other at a flying field for demonstration purposes.

Aviation Credit Reports Earnings

NEW YORK (N. Y.)—After deducting expenses and federal taxes, the Aviation Credit Corp. reported a net income of $225,451 for the nine months ending Dec. 31. On 250,000 shares of capital stock, this is equivalent to $.90 per share. The report states the book value of the stock is $20.90.

Detroit Will Exhibit 73 Planes of 34 Makers

DETROIT (MICH.)—Thirty-four airplane manufacturers, presenting an array of 73 different models, and 89 producers of aircraft accessories comprise the entry list for the Third Annual All American Aircraft Show, which is to be held here, April 5-13, in a new $1,000,000 hangar and exposition building on the municipal airport.

This announcement by Ray Cooper, show manager, is supplemented with the statement that practically all of the plane exhibitors will bring demonstration planes to Detroit, indicating that show week will see a giant fleet of approximately 150 flying craft assembled at the airport.

While an army of workmen is putting the finishing touches on the exposition building regarded as the largest structure of its kind in the country, show headquarters in the Detroit Board of Commerce are endeavoring to find additional exhibition space to take care of a waiting list which has piled up since announcement was made Jan. 1, that the show was "sold out." It is possible that a smaller hangar may be pressed into service.

The Detroit exhibition will be conducted by the Detroit Board of Commerce with the sanction of the Aeronautical Chamber of Commerce. Edward S. Evans, president of D.A.C., heads a group of twenty citizens directing the exposition, the vice-chairmen of which are: William B. Mayo, chief Ford Motor Co. engineer; Frank W. Blair, president of the Union Trust Co.; and William E. Metzger, a capitalist, formerly connected with the automotive industry and now interested in aviation.

Proposes Mass. Amendments

BOSTON (MASS.)—Rep. Harold R. Duffie, sponsor of the bill to provide an airplane for the state aviation inspector, has introduced three amendments to the state aviation laws. One requires that the registrar of motor vehicles be notified of all military and federal planes that are to operate within the state for more than ten days; second, he would make any pilot who "is not a proper person to operate" a plane, subject to loss of license. "This will give the inspector more authority and enable him to ground all undesirable pilots," said Duffie. The third amendment would require that all injuries to persons in crashes be reported to the registrar of motor vehicles. Present laws require that only damage to planes be reported.

Deputies Enforce Air Laws

SAN FRANCISCO (CALIF.) — The central coast council of the California State Chamber of Commerce has adopted a plan whereby the sheriff in each county of the state designates one deputy with the authority to enforce the state and federal laws governing air navigation.

Honduras Purchases Spartans

TULSA (OKLA.)—Two Spartan planes have been purchased by the Honduras government, a report states, and there is a tentative order for six more craft, to be equipped with machine gun carriages and bomb racks. These orders were the result of a sales trip made by R. W. Grigsby to Mexico, Guatemala, Salvador, and Honduras.

. . . And a Berth, Too

MODERN conveniences and comforts are embodied in the new Ford Club Plane recently announced. Folded away in the upper left-hand corner may be seen a full-sized berth.

N. Y. Legion Show Under Way

NEW YORK (N. Y.)—The second annual American Legion air show opened here Friday, Feb. 7, with some forty planes of commercial, military, and historical interest on display. Probably the most outstanding attraction was the new 18-passenger twin-engined Burnelli transport, similar in design to the original machine taken by P. W. Chapman. (A full account of the New York Show will appear in the next issue of AVIATION—Ed.)

Central Alloy Speeds Up Process

MASSILLON (OHIO)—Only 15 min. instead of 44 hr. is now required for heat treatment of special sheets with the use of a new normalizing furnace, especially designed by the company's engineering and metallurgical departments, according to a statement of the Central Alloy Steel Corp. This new furnace is being operated in the Canton, Ohio, plant.

Speakers Bureau for Minnesota

MINNEAPOLIS (MINN.)—An aviation speakers bureau has been organized here to furnish luncheon clubs and other organizations in the Twin Cities.

Bratton Measure Asks Accident Data Since '26

WASHINGTON (D. C.)—Further indication that Congress desires a change in the present aircraft accident reporting policy of the Department of Commerce is now given in a resolution introduced by Senator Bratton, of New Mexico. This resolution directs the Secretary of Commerce to furnish the Senate with full information respecting each aircraft accident which has occurred since May 20, 1926. The Secretary of Commerce also is asked to inform the Senate of the names of the persons involved in the accidents during this period, whether they were pilots or passengers, to specify the date and place of the accident, the make and model of the plane, and to report the complete findings of the department as to primary and contributing causes of the accidents.

A number of other Senators have evinced interest in the Bratton resolution: Senator Ransdell, of Louisiana, stated recently that he was in receipt of letters of approval from all sections of the country after he had introduced a resolution requesting the Secretary of Commerce to report to the Senate its findings on a particular air accident in which he was interested. As the Bratton measure is a Senate resolution, it only needs to be passed by that body and no action by the House is necessary. It has been referred to the Senate Commerce Committee.

Standpoints Compared

Senator Bratton has announced his intention of making public the information from the Commerce Department as soon as he receives it. The aviation industry can not expect to enjoy public confidence if the details and causes of its accidents are to be enshrouded in secrecy, he said. In defense of the policy of the Commerce Department, it has been pointed out that much of the air regulation work would be made ineffectual if there were too much publicity. A statement is made in this connection that constructive improvement in the methods of aircraft manufacturing companies is brought about by the present policy, whereas indiscriminate publicity would so injure some manufacturers that they would be compelled to close their plants.

Formula Given Incorrectly

Through an error in set-up, the speed formula at the top of the second column, page 238, in the feature story "The Guggenheim Safety Competition Tests and the Curtiss 'Tanager,'" in last week's issue, was given incorrectly. The formula read:

$$V_c = \frac{V_s + V_m - V_s}{3}$$

It should have read:

$$V_c = V_s + \frac{V_m - V_s}{3}$$

Plan New Planes For Coast Guard

Consider Seven Designs; May Appropriate $464,000

WASHINGTON (D.C.)—Selection of a design for new Coast Guard seaplanes is now taking place from seven plans submitted and a definite decision is expected within the next few days. The House has passed a $464,000 appropriation bill which is now before the Senate and which will account for the purchase of five machines, it is said. The Coast Guard desires delivery of the seaplanes before fall.

A new type of craft, capable of withstanding heavy seas and of performing long flights over water, is expected to be developed from the Coast Guard requirements. Standard ambulance and stretcher gear will be installed in these planes for use in transporting critical cases from ships at sea and from outlying islands to the mainland. Reserve power plant sufficient for the carriage of nine persons in emergency situations is required, although the normal capacity of the craft now planned will be four persons.

Performance and Specifications

Specifications follow: cruising radius, 1,000 mi. (nautical) at 80 knots; maximum speed, not less than 100 knots; calculated stalling speed, 48 knots; twin engines, with ability to fly on one engine when carrying fuel for 3 hr.; means for discharging rapidly, while in the air, all fuel except a 3 hr. supply for one power plant; crew, one first pilot and navigator, one second pilot, and one radio operator, and space for one passenger; radio equipment for 150 mi. transmission and reception when operating with surface craft; equipped with wheel gear that can be retracted during flight and lowered for use on a runway (the use of trucks is not desired); outfitted to carry one machine gun and necessary portable equipment commonly carried on seaplanes for extensive flights; propellers to be well clear of the water; lower wing (if any) and tail surfaces to be high enough above water to prevent damage in seaway; one main hull and two wing floats with maximum excess buoyancy and lateral stability in water; construction such that forced landings in sea will not result in the immediate loss of plane and crew; craft constructed of materials that will permit of operation for approximately 5 yr.; cockpit arrangements to permit one pilot to relieve any other one; dual control (single control adjustable for two pilots is not desirable).

Full load No. 1. Fuel and oil for 1,000 sea miles, at 80 knots, with three men in crew; 250 lb. in radio equipment; and 170 lb. miscellaneous.

Full load No. 2. Same as for load No. 1, save for a 3 hr. fuel supply to run one power plant.

Full load No. 3. Fuel, oil and weights as in full load No. 1, with the addition of one passenger, one Lewis machine gun, and two magazines of ammunition.

General remarks: dural hull is acceptable; no dural should be used for wing construction, flying truss, or control surfaces, except possibly for parts that carry minor loads, such as wing ribs and other sections, which, if corroded, will not detract from safety of craft. Dural hull and wing floats must be constructed to permit ready access for inspection, cleaning, and painting of interiors, and removable plates or manholes are required to accomplish this. It is necessary that these seaplanes be capable of maintenance in good condition without "factory" overhaul. Factors of safety for air loads must not be less than four and it is required that factors for landing loads be the maximum attainable, consistent with other requirements.

Power plants are to be radial air-cooled and of a type that has been in successful naval service for a period of not less than two years. In general, the construction standards of the Navy are required.

Prize for Black & Decker Exhibit

BALTIMORE (MD.)—Black & Decker Mfg. Co., Towson, Md., has been awarded first prize for its exhibit, from a sales standpoint, at the First Annual Aircraft Show held here in December. In addition to receiving a cup, the firm was complimented on the appearance of its J-6 Travel Air which will also be shown at the St. Louis International Aircraft Show. This craft is now making a nationwide tour.

Consolidated Outlines Fleet Dealership Policy

NEW YORK (N. Y)—Under the new sales system recently announced by the Consolidated Aircraft Corp., dealers will be compelled to take a minimum of three planes in order to secure the 25 per cent discount offered. The dealer must post a $500-per-plane deposit for these craft at the time dealership is granted. This money is returned as deliveries are made, and deposits are not required beyond the third plane.

R. W. Fulton, sales manager of Fleet Aircraft, Inc., Buffalo, announces that although the closed territory and distributorship policy has been eliminated, it is not the intent of the company to provide competition for several dealers in the same district unless representatives fail to make proper sales efforts. He also states that individual sales at dealer discounts will not be made by the factory.

The price of the recently reduced Kinner Fleet sport training planes is now $3,985. Kinner-powered Fleets equipped with Edo pontoons are listed at $4,995 and dealers are privileged to the same discount rates on that craft as apply to the other machines.

Firms Sanction Air Travel Costs

SEATTLE (WASH.)—A report revealed by K. K. Knickerbocker, Chicago representative for the Boeing System, reveals that the following business firms are among those which have authorized employees to file air travel expenses: Elgin Watch Co., Richfield, Sinclair, Standard, and Union oil companies; Goodrich, United States, and Goodyear rubber firms; Packard Motor Co.; Westinghouse Lamp Co.; Curtis Publishing Co.; and Western Electric Co.

Plan National Aviation, Aero Industries Merger

NEW YORK (N. Y.)—Directors of Aeronautical Industries, Inc., and National Aviation Corp., air investment firms, have approved a plan whereby the latter company will gain control of the former through an exchange of stock. Three shares of National stock will be given for four shares of Aero securities and the exchange will be made at book value, it is said. To make the exchange offer effective, 51 per cent of Aeronautical Industries stock must be deposited with the other concern.

On March 8, National Aviation stockholders will meet to vote on a proposed increase in authorized capital stock from 500,000 shares to 1,000,000 shares. The American Founders group, which owns an interest in both concerns, will have representatives on the enlarged board and on the executive committee. Shares of both companies are listed on the curb exchange.

A syndicate headed by G. M.-P. Murphy & Co. and James C. Willson & Co., formed National Aviation Corp. in June, 1928, first offering 150,000 shares and later 232,833. Aeronautical Industries, Inc., was organized in the same month and year by W. W. Townsend & Co. and 60,000 shares of capital stock was issued.

H. P. Restraining Order Vacated

NEW YORK (N. Y.)—A résumé of the Curtiss-Handley Page court action which followed the Guggenheim Competition has been issued here by the Curtiss Aeroplane & Motor Co. The action subsequent to the restraining order (AVIATION, page 70, Jan. 11) preventing Handley Page from removing his airplane from the country until courts had settled the matter of Handley Page's alleged violation of Curtiss patents is described in the following statement: "The court found that Handley Page had infringed Curtiss patents, and the Curtiss company then agreed to accept a payment of $500 as a license fee under the patents complained of for use made in this country of the Handley Page machine which had taken part in the Guggenheim Competition, conditional upon Handley Page company promptly shipping out of the country the above machine. The court then ordered the payment of this amount and further ordered that upon payment thereof, the restraining order should be vacated. The payment was made and the court order entered on Jan. 20, and the restraining order was thereupon automatically vacated."

Show Hanger Space Contracted

ST. LOUIS (MO.)—Twenty-four concerns have reserved storage space in the Von Hoffmann Service hangar at Lambert-St. Louis Field for the period of the International Aircraft Exposition, Feb. 15-23. The planes will be used for demonstrations.

NEW PLANES

Successful flight tests have been held on the Northrop, "flying wing," all-metal plane, developed by John K. Northrop, vice-president and chief engineer of the Northrop Aircraft Corp., Los Angeles, Calif., a subsidiary of U.A.&T. The all-wing craft has a high taper ratio and a 5.1-1 aspect ratio, a 30 ft. span, a 20 ft. length, 5 ft. overall, has a wing area of 184 sq.ft., a maximum wing thickness of 34 in., and weighs (gross) 1,600 lb. Experiments have been conducted with both pusher and tractor type propellers, a Mark III Cirrus engine and a Menasco A-4 four-in-line inverted power plant, respectively, being used for the two different tests.

Negotiations are now under way for the organization of a $250,000 plane manufacturing company at San Jose, Calif., which is now building a six-place monoplane in temporary quarters located at 23 South San Pedro St. Plans call for the erection of a factory 250 ft. square.

D. F. Fechtman, vice-president of the Metalair Corporation, Wichita, Kan., is designer of two all-metal low-wing planes nearing completion at the firm's factory. One is a five-place while the second is a two-place plane.

Demonstrations have been held on the small single-place monoplane made by the Spartanburg (S. C.) Aviation Co., according to N. E. Storms, and is designed to use a Model A or T converted Ford engine. This small plane has a 31 ft. span, weighs 230 lb. minus engine, has a 6 ft. 2 in. chord, a length of 20 ft., and is 8 ft. high.

A new training biplane is now being assembled by the Travel Air Mfg. Co., Wichita, Kan., which will incorporate design variations such as bucket type seats, double fuselage covering, and new fuselage features. It will be powered with a Wright J6-5.

Several Travel Airs Delivered

WICHITA (KAN.)—Four Travel Air biplanes have been delivered recently. Two, powered by Challenger engines, went to the Curtiss-Wright organizations at Denver, Colo., and New York. Two others powered by Wright J-5s are to be put in service on mail lines out of Montreal, Can. Orders for seven more planes to be delivered within the next few weeks have been confirmed, and business shows a definite uptrend for the company.

NYRBA Receives Fleetster

BUFFALO (N. Y.)—Performance tests are now taking place on the first of the Consolidated Fleetsters to be delivered to the New York, Rio & Buenos Aires Line, Inc. The craft was flown directly from the factory here to Miami where it was equipped with Edo pontoons.

Cabin Autogiro Which Pitcairn Firm is Testing

HERE IS THE FOUR-PLACE cabin Autogiro, of monococque fuselage of duralumin, which the Pitcairn company, Willow Grove, Pa., has imported from England. The rotor machine, which is powered by a specially-geared Wright J6-7, has been the object of much study and experimentation. Since this picture was taken, a new undercarriage with Goodyear Air-Wheels has been installed.

Prepare to Place ZRS-4 Ring

AKRON (OHIO)—The master ring of the Navy airship, ZRS-4 will be complete and ready to be hoisted into upright position at the dirigible hangar about Feb. 15, according to announcements by Goodyear-Zeppelin engineers.

Porterfield to Start Pay-As-You-Fly Chain

KANSAS CITY (KAN.) — Porterfield Flying School, which was purchased last year by the Universal Aviation Corp. from the American Eagle Aircraft Corp., has relinquished use of that name. Porterfield Aviation Interests, Inc., now will again use that designation in a new chain of pay-as-you-fly schools, an announcement states.

The Porterfield chain includes Porterfield Flying School, Inc., Kansas City; a school in Atchison, Kan.; Coffeyville Airways Corp., Coffeyville, Kan.; Carthage Airways Corp., Carthage, Mo.; and the American Eagle Company.

E. E. Porterfield, Jr., founder of the schools and head of the Porterfield chain, says his firm is planning to take over airports and start schools in various cities. A Transport Pilot is to bee placed in charge of each field and one or more Eagle planes will be used. Larry D. Ruch is to be supervisor of instructions for all the schools while "Art" Wintheriser will be chief instructor at the Kansas City and Atchison school.

Navy Parts Order to Baum

ELMHURST (L. I., N. Y.)—Seymour J. Baum, Inc., maker of flotation gear, tanks, sheet metal and wood parts, has been awarded a Navy Department order for spare parts totaling approximately $42,500 in value.

Air Associates Aids Water Gliding Venture

NEW YORK (N. Y.)—Air Associates, Inc., and a group of ten prominent aircraft executives and bankers, have signed a contract for the purpose of promoting water gliding. A syndicate has been formed for this purpose.

An experimental water glider, designed to take the air at low speeds when towed by the ordinary pleasure motor boat, has been designed by the organizer, Frederick W. Peel, service manager of Air Associates, and has been put into construction at Roosevelt Field by the syndicate, headed by George M. Pynchon, Jr., of Pynchon & Company; Frank M. Hawks, trans-continental record holder and glider enthusiast; and James B. Taylor, Jr., president of Air Associates, Inc.

The glider will take the form of a biplane boat with dural hull and is designed for one or two pilots. Following the completion of successful tests, ten models of the glider will be constructed by Air Associates.

Additional names on the syndicate list, all of whom are airplane owners, are: W. F. Davidson, of the Brooklyn Edison Co.; H. E. R. Hall, sportsman; W. H. Hooker, real estate operator; Richard F. Hoyt, partner of Hayden Stone & Co. and chairman of the board of the Curtiss-Wright Corp.; Charles L. Lawrance, president of the Wright Aeronautical Corp.; M. K. Lee, sportsman; and F. W. Zelcer, sportsman.

Flying "Trouble Shooter"

BOSTON (MASS.)—A flying "trouble shooter" has been provided by East Coast Aircraft in John Lewis Polando, a mechanic, who is also a qualified pilot. During the coming summer, he will be detailed to fly in answer to out-of-town calls for mechanical service.

Eminent U. S. Doctors On S. & C. America Trip

NEW YORK (N. Y.)—Six eminent American physicians and surgeons who attended the Pan American Medical Association conference at Panama City, Panama, on Jan. 29, are now completing an air trip which calls for stops in eleven Central and South American countries. The group, which left Miami on Jan. 24 in two Sikorsky amphibions of Pan American Airways, visited several of the countries while enroute to the conference.

Reports available at press time show the flying clinic is homeward bound and is due at Barranquilla, Colombia, on its way to Havana.

The group is composed of Dr. William Sharpe, president of the Broad Street and Pan American Hospital and clinics, New York; Dr. Fred H. Albee, consultant for bone surgery, Pan American Hospital; Dr. George W. Hawley, consulting orthopedic surgeon, Bridgeport, Conn.; Dr. Charles S. Gratz, director of Pan American Bone Fracture and Orthopedic clinic; Dr. Arnold H. Kegel and Dr. Alex A. Ford.

Tour Covers 6,808 Mi.

James M. Eaton, general traffic manager of Pan American Airways, Inc., outlined the medical clinic tour in cooperation with the American Medical Association. It covers 6,808 mi. in eighteen days. Stops where demonstration clinics are scheduled and the American physicians will confer with local medical authorities concerning new developments in the world of surgery and medicine, include Merida, Yucatan; San Lorenzo and Teguccigalpa, Honduras; Guatamala City, Guatamala; San Salvador, Salvador; Managua, Nicaragua; San Jose, Costa Rica; Caracas and Barranquilla, Venezuela; Panama City, Panama; Tela, Honduras; Belize, British Honduras; Havana, Santo Domingo, and Santiago, Cuba; Port au Prince, Haiti; and San Juan, Porto Rico.

Planes Listed for Omaha Show

OMAHA (NEB.)—Among the planes to be exhibited at the Omaha auto-air show, Feb. 17-22, will be: a Bellanca and a Monocoupe by Rapid Aviation, Inc., Omaha; a sport trainer of Overland Airways, Omaha; one or two Wacos belonging to Pioneer Aircraft, Omaha; a Midwest Aviation, Inc., J-6 Travel Air; a Curtiss Robin of Sidles Airways, Lincoln; and craft belonging to the Hanford and Kari-Keen plane companies.

Denver Body Plans Meet, Tour

DENVER (COLO)—William D. Nash is president of the Junior Chamber of Commerce which is making plans to hold an annual Rocky Mountain region aviation meet here, to be preceded by an air tour. No dates have been set as yet.

Start Irving Canadian Plant

BUFFALO (N. Y.)—Ground has been broken at Bridgeburg, Ontario, for the construction of a Canadian Irving Air Chute factory, states George Waite, president of the firm. The plant is expected to be ready by summer.

Arrow Aircraft Firm Appoints New Dealers

HAVELOCK (NEB.)—A number of dealer changes are announced by Arrow Aircraft & Motors Corp., which recently reported a new sales policy for 1930. Among them is Harry Day, Roosevelt Field, L. I., former eastern sales representative, who is now in charge of locating regional agents in the New England states, New York, New Jersey, Pennsylvania, Maryland, Delaware, and District of Columbia. He also holds the Arrow franchise in the New York metropolitan district.

Some of the New England privileges have gone to Edgar Cate, Portland, Me., for state of Maine; North Shore Airways, Beverly Airport, Boston, for state of Massachusetts; and Ted Kenyon, pilot on the Colonial New York-Boston line, for privileges at Boston Airport.

Other representatives will be located at Pittsburgh, Pa., where an Arrow school and flying service is to be maintained; at Medford, Ore., where the Eckerson Flying Service will handle the franchise for the western half of the state; at Kansas City, where the Saunders Fly-It-Yourself system will be regional distributor; and at Fergus Falls, Mont., where Fergus Falls Air Service, Inc., will handle Arrow sales.

De Havilland of Canada Makes Financial Report

TORONTO (CAN.)—Net profits, after depreciation, but before federal taxes were subtracted, amounted to $85,238 for De Havilland Aircraft of Canada, Ltd., for the thirteen months ending Sept. 30, 1929, a report states. This is more than four times the amount required for the annual dividends on the outstanding preference stock.

After payment of depreciation, income tax, all expenses and preferred dividends, there was a balance as of Sept. 30, 1929, of $60,067, which is at the rate of $2.40 on the class A shares. These shares are traded in on the Toronto Curb Exchange and were given as a bonus last March with the 7 per cent preferred stock offered at that time by K. F. MacLaren & Co., Ltd., Toronto.

Financial Data

Ratio of current assets to current liabilities is approximately five to one. Current assets, amounting to $377,847, are made up of cash, $144,842; accounts receivable, $69,594; inventory, $163,411. Current liabilities of $77,334 consist of accounts payable, $71,000, and accrued charges, $6,334. There is an item mortgage payable, $21,400, and reserve for Dominion income tax, $7,000. Total assets amount to $498,641.

Though the new buildings and hangar were not taken over until September of 1929, a full year's depreciation has been taken out on the equipment, according to W. R. P. Parker, vice-president of the firm. Moving expenses were $4,562, and the loss on the sale of the old hangar was announced as $1,136.

American Legion to Build Cathedral at Lakehurst As Memorial to Famous Fliers and Air Pioneers

LAKEHURST (N.J.)—A memorial to those fliers who lost their lives during the war and to other aviation pioneers whose work is finished, is to be erected at the Naval flying field here in the form of a chapel.

It will be called "The Cathedral of the Air" and is the result of an idea fostered by Herbert H. Blizzard, of Audubon, Commander of the New Jersey Department of the American Legion; the Rev. Gill Robb Wilson, of Trenton, formerly national chaplain; and Comdr. William W. Edel, Ch.C., U. S. Navy, stationed at the Naval Air Station here.

The $150,000 to $175,000 necessary for its construction is expected to be raised between Lincoln's and Washington's birthday. To raise this fund, thousands of loose-leaf pages are being sold and after the person has inscribed his or her autograph on one, it will be buried in the chapel to perpetuate the names of the donors.

Paul Philippe Cret, of Philadelphia, designer of many war memorials, will draw the plans and supervise the construction of the chapel which will be of modified Gothic style. The American Legion Memorial Chapel Association has been formed to aid in the venture, and Governor Morgan F. Larson, of New Jersey, has appointed his own committee, of which he is chairman, to cooperate with the Legion.

"The Cathedral of the Air" will be strictly non-sectarian and be so built and appointed that all creeds may use it as a house of worship. Different parts of the chapel will be dedicated to those who died in various branches of aviation. Portions of the "Shenandoah," wrecked near Ava, Ohio, in 1925, will be used in construction of a small side-chapel in memory of the men killed in that ship.

The act authorizing the building of this memorial was signed by President Coolidge on Nov. 2, 1929, after having passed the Senate and the House of Representatives. A measure passed in connection with it states that the U. S. Government shall maintain the chapel and provide a chaplain. Commander W. Edel has been selected as the first one.

Contributions for the project may be mailed to Bayard F. Kraft, treasurer, 525 Cooper St., Camden, N. J.

Gipsy Engine Completes 300-Hr. Endurance Test

ST. LOUIS (MO.)—The first Gipsy engine manufactured by the Wright Aeronautical Corp. here, recently completed a 300-hr. endurance run test. After a thorough inspection, the power plant will be put back on the test stand for a continuation of its endurance run.

The present outlay and equipment of the factory, located at 428 Adelaide Ave., is the result of plans made by W. K. Swigert, vice-president and general manager of Wright Aeronautical. The Gipsy, originally a British engine but changed slightly to conform to American requirements, is now under production at the rate of ten daily, it is asserted.

W. K. Swigert

Among the features of the factory is a department where a machine insures the static and dynamic balance of the crankshaft. The latest type of system for gasoline supply has been installed. Two tanks, one holding 10,000 gal. and the other 500 gal., care for fuel. The gas is supplied to the test houses and through the factory by forcing it out of the tanks by water pressure.

When an engine is completely assembled, it is carried on a mono-rail system to the testing cell where it is put on a 4-hr. production test run. It is then disassembled, re-inspected by parts, re-assembled and given a final 2-hr. test run.

Control rooms of the test house are equipped with many instruments used in airplanes. Each control room has two instrument boards from which engines in adjoining rooms are operated by one tester. A careful record of the performance of each engine on test is kept, and each plant is required to perform well within guaranteed specifications before it is released for delivery. It is said over 100 aeronautical concerns throughout the country have written for information concerning the Gipsy, which is standard power equipment on all Curtiss Moth planes.

W. K. Swigert was in charge of aviation engine-building at the Nordyke-Marmon Co., Indianapolis, which manufactured Liberty and Hall-Scott power plants for the government during the war. He has also been connected with the machine tool business, the U. S. Ordnance Department, and several automotive concerns. Mr. Swigert joined the Wright Aeronautical Corp. in January of 1929.

The Wright Gipsy on the test stand

Curtiss-Wright Base At Syracuse to Close

NEW YORK (N.Y.)—An announcement from the Curtiss-Wright Corp. states it will relinquish its base at Syracuse, N. Y., because of the fact there is no immediate prospect of having the municipal airport there approved by the Department of Commerce, as suitable for student instruction.

"It is a matter of great regret," Mr. Hood, manager of the Curtiss-Wright Flying Service here, declared, "to us to bring to an end our activities in Syracuse.

"The officers of our company, however, regard the situation as almost hopeless. With a road running across the airport and part of the field's area still under private control, the Department of Commerce inspectors refuse definitely to approve the field for instruction and the City of Syracuse has not yet taken the necessary action to remove these obstacles to a safe field for student pilots."

Curtiss-Wright has eighteen planes and sixteen employees stationed at the Syracuse branch. Both men and planes will be transferred to other Curtiss-Wright bases, it is believed.

Approve Kitty Hawk Memorial

WASHINGTON (D. C.)—A favorable report has been made by the House Library Committee on the bill presented by Representative Warren, of North Carolina, for the erection of an 85-ft. memorial to the Wright brothers at Kitty Hawk, N. C. This tribute to the first flight made by Wilbur and Orville Wright on Dec. 17, 1903, would be set on top of Kill Devil Hill, a few hundred yards from the Atlantic Ocean and the tower would contain a powerful steamship guide light. The memorial would cost $238,000, and Mr. Warren has urged that it be built of North Carolina granite. Frank Stick, and associates, of New Jersey, has deeded 500 acres of land, which includes Kill Devil Hill, to the government as a gift. The North Carolina State Highway Commission is planning to build a hard surface road for a distance of 17 mi. down the beach.

A. H. Orlebar Receives Thompson Speed Trophy

WASHINGTON (D. C.)—The Thompson Speed Trophy, emblematic of the speed championship of the air, was presented on Feb. 5 to the British Ambassador, Sir Esme Howard, by Senator Hiram Bingham, president of the National Aeronautic Association. Under the conditions of the award the trophy may never leave the United States. A replica passes into the possession of British Squadron Leader A. H. Orlebar, who won the trophy last Sept. 12 with a world record speed of 357.723 m.p.h. in the Supermarine Rolls-Royce S-6.

Thirty American naval reserve aviators who formed the original Yale esquadrille at the time of the war, donated the trophy in honor of Louis S. Thompson, of Red Bank, N. J., one of the organizers of the unit. David S. Ingalls, Assistant Secretary of the Navy for Aeronautics, and F. Trubee Davison, Assistant Secretary of War for Aeronautics, both of whom were members of the unit, attended the presentation.

To be Retained by Embassy

The trophy is unusual and handsome in design. A golden comet is inlaid on a silver globe bearing the map of the heavens, which is supported by a simple standard on whose base is engraved the name and achievements of the winners. When won by a foreign aviator, the trophy is held by the embassy representing his country in Washington. Victory by an American military aviator will result in the award of the trophy to that branch of the government represented by him. Individual replicas of the award become the personal property of the winning aviator.

Bendix Inaugurates Vast Service System

CHICAGO (ILL.) — Bendix Aviation Corp. announces the inauguration of an extensive system of service for Bendix products through a chain of specially equipped and manned service stations, to include London and Paris bases.

Ten direct branches are to be opened in principal cities in this country, states William L. O'Neill, vice-president of the Bendix Aviation Corp., and service stations will be installed in the plants of 100 Bendix distributors.

These offices will have supervision over 2,500 to 3,000 sub-service stations, each fully equipped with ample facilities for taking care of Bendix starter-drives, brakes, generators, magnetos, and Stromberg carburetors and for testing brakes with Bendix-Cowdrey machines.

To insure the proficiency of the mechanics, those needing additional instruction will be sent to Bendix training schools for a course in product-servicing. Company experts will tour the country, acquainting station managers with the latest service methods and new Bendix products.

PERSONNEL

JOHN D. HARDESTY, formerly of the Los Angeles, Calif., city engineer's office, is now airport inspector for Corporacion Aeronautica de Transportes, S.A., with headquarters at Torreon, Mexico.

SCHUYLER KLEINHAAS, formerly with Keystone Aircraft Corp., has been assigned to the design division in the engineering department of Sikorsky Manufacturing Co., Bridgeport, Conn.

HAYES S. WALTER is now sales manager of the parts division of Nicholas Beazley Airplane Co., Inc., Marshall, Mo.

L. F. Ross has resigned as aviation editor of the Cleveland (Ohio) *News* to become publicity director for Cleveland Pneumatic Tool Co., makers of Aerol struts.

S. S. BOGGS has been promoted to the position of airways engineer in the Fort Worth, Tex., district, for Varney Air Lines. G. R. FITZGERALD succeeds him as airways extension supervisor.

AUSTIN F. BEMENT, NEWTON SKILLMAN, DR. NEAL GATES, MICHAEL J. FRITZ and J. W. EDWARDS have been elected to the board of directors of Flo Flying Services, Inc., Ann Arbor and Detroit, Mich.

GEORGE H. STARR will represent Curtiss-Wright Sales Corp., in western New York state.

C. M. BRADLEY has been appointed field manager for T.A.T.-Maddux Air Lines at Port Columbus, Ohio. He held the same position at Clovis, N. M.

H. M. HORNER, assistant treasurer of Pratt & Whitney Aircraft Co., Hartford, Conn., has been appointed assistant secretary.

CHARLES MERRIAM, assistant treasurer of Skyways, Inc., is resigning to move to California.

ROBERT BERGERSEN, former Boeing pilot, has joined the staff of Rankin Flying Service, Portland, Ore., as airplane salesman.

THOMAS WARD has been appointed chief test pilot for Miami (Fla.) Aircraft Corp.

GEORGE COBB, formerly with Curtiss-Wright Flying Service, has been appointed chief pilot on the Miami-Havana route operated by New York, Rio & Buenos Aires Line. ROBERT T. HIVELY and M. M. AYRES, formerly pilots for Pan American Airways, are now NYRBA pilots.

MAX E. PARKER, Hollywood, Calif., and ELDON J. DICK, Tulsa, Okla., have been added to the advisory board of Aircraft Finance Corp. of America.

S. WADE GREAVES has been appointed manager of Parks Air College office at Toledo, Ohio.

LOUIS B. CARVER has joined the staff of Curtiss-Wright Flying Service at Syracuse, N. Y.

R. D. W. CLAPP, president; E. A. WATKINS, vice-president; C. E. PARR, treasurer; H. L. BRIDGMAN, secretary and general manager; were re-elected at the recent annual meeting of Watkins Aircraft Co. stockholders, Wichita, Kan.

H. W. BARLOW, formerly staff engineer in charge of structural analysis for Glenn L. Martin Co., has resigned to join the staff of Gazley & LaSha, consulting aeronautical engineers.

VIRGIL SIMMONS and HERBERT MARSH have been added to the teaching staff of Boeing School of Aeronautics, Oakland, Calif.

E. E. MOUTON, district superintendent of aeronautics for the Department of Commerce, has resigned from the Citizens' Airport Advisory Committee of San Francisco.

WILTON M. BRINEY, formerly sales manager for Butler Aircraft Corp., has been added to the sales staff of Spartan Aircraft Co., Tulsa, Okla.

FRANK RILEY has joined the sales staff of the St. Louis Curtiss-Wright Flying Service.

MAJOR F. N. SHUMAKER has arrived in Shanghai, China, as representative of The Aviation Corp.

DR. BRUCE E. LINDSEY, Columbus, Ohio, has been appointed examiner for Curtiss-Wright Flying Service and T.A.T.-Maddux in the central part of the state.

New Firms Announced

CONTINENTAL AVIATION CORP., Northern Life Tower, Seattle, Wash.; capital $240,000; by M. W. Giddings and E. R. Willard; to manufacture airplanes and do an air service business.

MARTIN AIRPORT CORP. OF WASHINGTON, Vancouver, Wash.; capital $50,000; by Emil W. Martin, William Hall, and Randolph Hall; to manufacture airplanes, operate schools, and do an air transportation business.

Start Martin Plane Order

BALTIMORE (MD.)—The steel keel of the first of 40 flying boats to be built by the Glenn L. Martin Co. for the government has just been laid in the company's new factory at Middle River. Thirty of the flying boats are to be biplanes and ten monoplanes. There are also under construction several experimental planes, including what is termed the largest flying boat ever to be built in this country. It will be delivered to the Navy and was contracted for at a price of $150,000. Delivery of the 40 flying boats under construction is to be commenced in the early spring and is to completed by November, but the large experimental craft will require another year. Unfilled service orders of the Glenn L. Martin Co. amount to more than $2,500,000, a report states. The full force of 1,200 men is working on the order, with a night shift also employed.

Aero Branch Library Called Country's Finest

WASHINGTON (D. C.)—In three years, the Aeronautics Branch has built up the finest and largest commercial aeronautical library in this country, according to a statement made recently by Robert S. Clary, chief of the editorial section, Aeronautics Branch.

As well as 438 bound volumes, catalogued, there are more than 10,000 domestic and foreign magazines, articles, pamphlets and reports on file as a part of the statistics and distribution section of the Department of Commerce aeronautical development service; the library therefore is kept up to date with all government and industry bulletins and aviation documents, while semi-monthly a bulletin is issued by the library, listing the more important articles in current publications.

Bulletins Numerous

A list of bulletins published by the government includes: Aeronautics Commerce Bulletin, published monthly; technical notes and memoranda, reports, aircraft analyses of the National Advisory Committee on Aeronautics; foreign aviation news, commerce reports, which are published by the Bureau of Foreign and Domestic Commerce; and airway bulletins, each of which describes a field, which are especially for use by pilots who are unfamiliar with the country.

Some 603 of these air base descriptions had been published by the Aeronautics Branch by the end of the last fiscal year and sent out to 3,400 persons, while 401 airports are to be made the subject of future bulletins. An estimate discloses that air bases are being established at the rate of approximately 75 per month. Full information concerning nearly 6,000 sites which can be turned into landing fields if so desired, must be obtained by the Aeronautics Branch.

Many Revised and Re-Issued

The following publications are revised and re-issued about once a year: Civil Aeronautics in the United States, Designing Safe and Adequate Airports. Notes on Airport Lighting, Aeronautical Trade Directory, Airmarking, Airports and Landing Fields, Aeronautical Publications, Air Commerce Regulations, Airworthiness Requirements, Flying School Supplement, Entry and Clearance of Aircraft, Air Traffic Rules, Airport Rating Regulations, Airport Management, Aviation Training, and Suggested City or County Air Ordinances and Uniform Rules for Airports. All these may be secured from the Department of Commerce upon request.

A survey of foreign aviation trade magazines showed there are fourteen in France, ten in Germany, eight in Italy, and five in Great Britain, while the United States has approximately twenty such journals. Nearly every civilized country in the world, it is stated, publishes at least one aeronautical trade paper or magazine.

BRIEFLY

On Feb. 5, there were 10,596 licensed pilots in the U. S., according to a Department of Commerce statement. Up to Dec. 31, 1929, 30,662 student permits had been issued. Active licenses are held by 7,839 mechanics, there are 6,753 licensed planes, and 3,152 planes identified. Thirty-one flying schools, with 116 flying instructors and 167 ground instructors have been approved. Approved type certificates have been issued to 287 planes, 41 engines, 136 propellers, while 173 planes, 11 domestic and 14 foreign engines have been approved without receiving certificates.

The Sikorsky plane owned by Pan American Oil Corp. is making a month's tour of Florida, piloted by W. B. Murphy and M. L. Sater.

Gazley and LaSha, Washington, D. C., will design a two-place cabin monoplane for Kari-Keen Aircraft, Inc., Sioux City, Ia.

Several airplane manufacturers and distributors took space at the Kansas City Motor Show, which opened Feb. 8.

A bill appropriating $10,000 for the purchase of an airplane for use by the aviation section of the registry of motor vehicles has been favorably reported by the motor vehicles committee of the Massachusetts legislature.

While in St. Paul, Minn., Maj. Ralph Royce, commanding officer of the group of army planes which recently flew across the country in a test of performance under winter flying conditions, gave a lecture on the Curtiss D-12 engine to students at Great Northern Aviation School.

Mid-West Aviation Corp., Council Bluffs, Ia., has recently sold three Travel Air planes, including a cabin model.

Lieut. Clayton C. Jerome received the commendation of Maj. Gen. W. C. Neville, commandant of the Marine Corps at San Diego, for making a safe landing with his plane after the control stick broke off at the socket while he was in mid-air.

Nicholas-Beazley Airplane Mfg. Co., Inc., Marshall, Mo., reports the sale of four Barling NB-3 monoplanes in Texas, three in Canada, and one in Kansas City.

Approved type certificate No. 292 has been awarded to the Stinson Junior Speedmail plane, making the seventh which has been awarded to Stinson machines. The new plane was tested with Wasp engine, but will be tested again with Wasp Junior and Wright J-6 300 hp. engines.

Rear Admiral Richard E. Byrd has been awarded a gold medal by the Chicago Geographical Society.

Invitations to attend the St. Louis International Aircraft Exposition were sent to more than 5,000 American pilots.

Richards-Wilcox Manufacturing Co., makers of hangar door hardware and similar products, has issued a special number of the company publication to commemorate the 50th anniversary of the founding of the firm.

Dr. C. Francis Jenkins, Washington, D. C., is experimenting with a radio antenna held horizontal behind the tail of a plane by a wind sock, thus tending to eliminate engine interference.

Horace E. Dodge Boat & Plane Corp., chartered in Delaware, has filed a certificate in the office of the Secretary of State to allow it to do business in New York. The New York City office is at 511 Fifth Avenue.

William G. Swan of Tampa, Fla., has perfected a pivotal arrangement for holding a very small plane to give students the effect of flight, use of controls, etc., without leaving the ground.

AERONAUTICAL CALENDAR

Feb. 20-22	Second Annual Aviators Reunion Aviation Post No. 601, American Legion, Chicago, Illinois.
Feb. 22-23	Reunion of World War Pilots, auspices Aviation Post of American Legion, Chicago, Ill.
May 27-30	All-New England Air Tour, starting from Springfield Airport, Springfield, Mass.
May 30-June 1	Dedication and Air Meet, Bowles Airport, Springfield, Mass.
June 28	Annual R.A.F. Display, Hendon, Eng.
	EXPOSITIONS
Feb. 15-23	International Aircraft Exposition, St. Louis, Mo
Mar. 6-15	Second Annual Pittsburgh Aircraft Show. Motor Square Garden, Brown Boulevard, Pittsburgh, Pa. Show Director, Ray Krimm, Pittsburgh, William Penn Hotel.
Mar. 22-29	Second Annual Aviation Exposition, Buffalo, N. Y.
Mar. 22-29	Camden, N. J., Aircraft Show, Convention Hall, Camden, N. J. L. D. Odhner, executive secretary, Hotel Walt Whitman Annex.
Mar. 26-Apr. 1	Cincinnati, Ohio, Aircraft Show.
April 5-12	All-American Aircraft Show, Detroit.
May 3-10	New York Aircraft Salon, auspices Metropolitan New York Division, Distributor-Dealers Section, Aeronautical Chamber of Commerce, at Madison Square Garden, New York City.
July 6	International Transportation Exposition, Warsaw, Poland.
	MEETINGS AND CONFERENCES
Feb. 18-20	Meeting of Society of Automotive Engineers, St. Louis, Mo.
Feb. 20	Meeting of Committee on Airport Management, Standards and Ethics, Hotel Jefferson, St. Louis, Mo.
Feb. 24-25	Conference on Aviation Law, Auspices Milwaukee (Wis.) Chapter, N. A. A.
Mar. 5	New York State Airport Conference, Auspices A. C. of C., Mark Twain Hotel, Elmira, N. Y.
Mar. 17	Regional Airport Conference for New England, Providence, R. I.
Mar. 27-28	Mid-South Aeronautic Association Convention, Auspices Chamber of Commerce, Memphis, Tenn.
Apr. 8-9	Meeting of Society of Automotive Engineers, Detroit, Mich.
May 14-16	National Conference, Airport Section, Aeronautical Chamber of Commerce, Buffalo, N. Y.
July 3-5	Western States Aeronautical Conference, Medford, Ore.

TRADE TIPS

It has been reported that

A. S. Koch, vice-president and general manager of Mohawk Aircraft Corp., Minneapolis, Minn., will tour the southwest in March to appoint distributors and dealers for the Pinto plane.

The city of Duluth, Minn., will erect a combination administration building and hangar at the municipal airport.

Desoutter Aircraft Co., Ltd., Croydon, England, will open negotiations with anyone interested in acquiring the American manufacturing rights or agency for the Desoutter sports coupe.

City council of Hanford, Calif., has called for bids for the erection of a hangar of corrugated iron 60x70 ft. D. C. Williams is city clerk.

Bids will be asked soon for lighting equipment to cost about $9,000 for Sweetwater (Tex.) municipal airport.

Schools and Colleges

AMERICAN EAGLE AIRCRAFT CORP., of Dallas, Tex., which is affiliated with the Porterfield Aviation Interests, Inc., of Kansas City, announce the opening of a school at Love Field Airport on Feb. 15, to be supervised by Harry A. Hammill. Capt. Ray E. Allen and Miss Jean La Rene will be the instructors.

GREAT NORTHERN AVIATION SCHOOLS, St. Paul, Minn., graduated twenty-five students on Feb. 5.

UNIVERSITY OF MINNESOTA is offering evening courses in aviation in its extension division. Airplane construction, airplane engines, aerial navigation and elementary aeronautics are the subjects taught.

PURDUE UNIVERSITY, Lafayette, Ind., has been loaned a Curtiss Robin cabin plane by the Curtiss-Wright Flying Service of Indiana for use in class work.

RANKIN SCHOOL OF FLYING, Portland, Ore., is giving its advanced students solo experience on a Great Lakes trainer plane equipped with skis. The school reports an enrollment of about 125 students.

RAPID AVIATION, INC., Council Bluffs, has opened a class in aviation for girls.

SHANK FLYING SERVICE, Robbinsdale, Minn., has equipped all the planes used in its school division with skis for winter flying.

SKYWAYS, INC., has started a flying school at Cleveland, Ohio, to qualify students for private, limited commercial, and transport licenses.

SPARTAN SCHOOLS OF AERONAUTICS, Tulsa, Okla., report an enrollment of 123 active students.

U. S. AIRCRAFT ENGINEERING SCHOOL, Kansas City, Mo., is starting its second year. Opening a year ago with an enrollment of ten, it now has 157 students.

AIRPORTS AND AIRLINES

Aviation Corp. Forms New Airline Organization

NEW YORK (N. Y.)—American Airways, Inc., has been formed by The Aviation Corp., which has headquarters in this city, to take over and operate all its airline subsidiaries. This concentration of airline operations will come under the direction of James F. Hamilton, former president of New York State Railways, who will be president of the new organization, and it will include Interstate Airlines, Colonial Airways System, Universal Aviation Corp., Southern Air Transport, Cuban Flying Service and Alaskan Airways.

The work of consolidating these units into one system has been going on for several months and all details have not been completed as yet. There is to be no public financing of the new company, this phase of the transaction being taken care of by transfer of stock within the corporation. There are to be various changes in the personnel organization for increased efficiency and economy under the new company. An announcement about these is to be made soon.

Individual Names Dropped

The names of the various units have been dropped and all are being operated under the name of American Airways, Inc. There will be three divisions—Universal Division with headquarters at St. Louis, Southern Division with headquarters in Fort Worth and Colonial Division with headquarters in this city.

The first airline innovation to be made by the new company is the inauguration of a through service between Cleveland and Dallas using three-engined transports, the Fokker F-10. These planes will be flown via Chicago from which point the route splits, one plane being flown to Tulsa via Kansas City and the other to Tulsa by way of St. Louis. At Tulsa the routes converge again and continue to Dallas by way of Fort Worth. The St. Louis-Tulsa link is a new service. The entire route is flown in one day. The schedule is as follows:

Westbound			Eastbound
9:05 a.m.	Lv.	Cleveland	Ar. 7:45 p.m.
10:50 a.m.	Ar.	Chicago	Lv. 4:00 p.m.
11:00 a.m.	Lv.	Chicago	Ar. 3:55 p.m.
1:25 p.m.	Ar.	St. Louis	Lv. 1:40 p.m.
1:50 p.m.	Lv.	St. Louis	Ar. 1:15 p.m.
5:10 p.m.	Ar.	Tulsa	Lv. 10:15 a.m.
11:00 a.m.	Lv.	Chicago	Ar. 3:55 p.m.
3:05 p.m.	Lv.	Kansas City	Lv. 12:15 p.m.
5:10 p.m.	Ar.	Tulsa	Lv. 10:15 a.m.
5:15 p.m.	Lv.	Tulsa	Lv. 10:10 a.m.
7:50 p.m.	Lv.	Fort Worth	Lv. 8:05 a.m.
8:15 p.m.	Ar.	Dallas	Lv. 7:40 a.m.

Overnight train connections may be made at all important stops along the route. Service opened Feb. 10.

Chamber Approves Mail Bill

NEW YORK (N. Y.)—The Aeronautical Chamber of Commerce has forwarded to members of the Senate and House of Representatives Committees on Post Offices and Post Roads its approval of the air mail bill which has been advanced by Postmaster General Brown and others as a solution of the air mail situation. (See AVIATION for Feb. 8).

Pontiac Airport Gets The First A-1-A Rating

WASHINGTON (D. C.)—An A-1-A rating, the first to be given any airport under the system devised by the Aeronautics Branch, has been awarded to the Pontiac (Mich.) Municipal Airport. In making this announcement, the Aeronautics Branch pointed out that this does not mean necessarily that the Pontiac plant represents an ideal development. The rating signifies merely that it meets the minimum requirements in the highest classification of the rating system. The airport will bear the serial number 1.

The first letter of the rating refers, of course, to the type of general facilities provided by the airport. The number indicates the characteristics of the effective landing area and the second letter indicates the type of lighting equipment with which the airport has been provided. Delay in the awarding of ratings has been explained by the government as due to failure of airports to qualify for the rating desired when federal inspection of the airport was carried out. Applications are being acted upon in the order received.

The Pontiac port is rectangular in shape, includes about 240 acres, measures 2,640x3,960 ft. The soil is gravelly sand. There is one hangar—measuring 100x100x20 ft. The port is 6 mi. northwest of the city. It was dedicated in June with an air meet.

Disagreement in South America

WASHINGTON (D. C.)—Co-operation between American and French airline companies in South America which hitherto has been quite congenial has become less so in recent weeks, with the result that one or more of the American airline companies may be refused permission to operate over French West Indian territory. New York, Rio & Buenos Aires Line is chiefly concerned with the outcome of present negotiations now going on between Aeropostale and American interests. One of the principal causes for the present negotiations are said to be the differences in tariff policies.

P.A.A. Planes Flew 2,086,000 Mi. in 1929

NEW YORK (N. Y.)—According to a report on its 1929 operations, Pan American Airways System (including Pan American-Grace and Mexican Aviation Co.) flew its planes a total of 2,086,000 mi. during the year as compared with 149,824 mi. for 1928 and only 11,970 mi. in 1927. The company now operates over airways totalling about 10,487 mi., of which all but the 261 mi. on the Miami-Havana section were placed in operation last year. This mileage places Pan American with the first two or three of the world's airline operators in point of length of airways flown.

Ninety-eight per cent of its scheduled trips were completed last year, the report states, and 91.43 per cent of the scheduled trips were completed on time. Only .21 per cent were incompleted because of mechanical difficulties and but .85 per cent were cancelled because of unfavorable weather.

Pan American is operating 42 two- and three-engined transports. On the company's Division 1 (the West Indies lines), the Fokkers were flown an average of 494 hr. each during the year and one machine was flown 913 hr. The Sikorskys were in the air an average of 522 hr. each and one was credited with 744 hr. Reports from the other divisions were said to be similar but were not included in the report.

Every transport company is faced with the logical task of incorporating in its flying equipment various adjustments and refinements which experience indicates from time to time is desirable. These changes do not necessarily reflect on the manufacturer but represent the operators' attempts to provide the best equipment to meet the special conditions encountered in operating its particular routes. Pan American has made 154 improvements on its planes during the year to meet the special conditions imposed by tropical climate, salt water landings, etc. Practically all of these improvements were minor ones, such as re-enforcement of certain struts to counteract vibration, protection of parts against corrosion, and the like. About 144 of these improvements were the result of employees' suggestions.

Booklet Describes Port Columbus

COLUMBUS (OHIO)—Official rules, regulations, rates and charges of Port Columbus, have been published in booklet form now ready for distribution to all operators and airports in the United States, according to Maj. William F. Centner, superintendent of the port.

S. A. Airline Map Shows Many Routes

WASHINGTON (D. C.)—The Department of Commerce has issued a map of the operating, proposed and suspended airlines in South America. The letter P indicates a proposed line, the letter S indicates a suspended line, and those lines without any letters are in operation at the present time. This map was prepared by the Aeronautics Trade Division of the Bureau of Foreign and Domestic Commerce at Washington. [It is published as prepared, with the exception of the addition of the Chilean National Airlines route south from Santiago to Puerto Montt and the change in designation of the New York, Rio & Buenos Aires line between Buenos Aires and Para at the mouth of the Amazon from the proposed to the operating classification.]

It is obvious that the South American territory is attracting serious attention from American, French and German interests as well as that of several countries on the continent who have established their own services. The West Coast already is well covered with lines in operation, one of these being Pan American-Grace. The North Coast is served to some extent and the East Coast is being developed rapidly by three companies—two American and the French Aeropostale. The latter has been operating a mail service between Buenos Aires and Natal for almost two years. The New York, Rio & Buenos Aires Line has developed its passenger and mail service from Buenos Aires as far north as Para and plans to have practically all of its lines in operation through to New York before the end of this month. Several interior services are operated northward from Argentina junction points and southward into Colombia, while the Peruvian Naval Lines serves the central part of Peru.

Airport Ethics Committee to Meet

ST. LOUIS (MO.)—Standardization of service charges at airports is the subject for discussion by the committee on airport standards and ethics, Airport Section of the Aeronautical Chamber of Commerce, which meets Feb. 15 at the Hotel Jefferson here. It is expected that a suggested standard rate schedule and a code of airport management ethics will be prepared, as well as a program for the second National Airport Conference at Buffalo, May 14-16. David Visel, vice-president of the Curtiss-Wright Airports Corp., is chairman.

Showing the fast-spreading airline network in South America

Air Traffic Control Committee Makes Report

WASHINGTON (D. C.)—A wide divergency in air traffic controls systems prevail throughout the country, according to the reports contained in the questionnaire broadcast by the Committee on Standard Signal Systems for Airports. It was said the canvass indicated general agreement that solution of the airport traffic control is vitally important and that a uniform system for the entire country would be of great value. The committee's comment on these reports follows in part:

"The reports indicate sirens are in use at a few of the larger airports and are quite effective in conveying information to ground operations. Visual signals include a wide variety of devices. Vari-colored flags are used in some cases. At a western airport, red and green semaphores, operated from the control tower, are employed. At night, red lights are placed on these semaphores. Three other western airports have erected two steel panels, red on one side and white on the other, which are used to control transport planes in flight. The Very pistol, red and green illuminations of the wind tee, and blinking of the boundary lights, are night signaling methods.

"At still another western airport, experiments are being carried on with signal lights mounted at the ends of runways; but the system has been in use too short a time to give the committee an opinion regarding its feasibility.

"An investigation has been made of the systems in use at foreign airports, including Croydon, England; Tempelhof, Berlin; and Ie Bourget, Paris. The problems at these ports, however, differ from those encountered on a larger terminal airport in this country as operations abroad are confined almost entirely to scheduled transport.

"The majority of those canvassed stressed radio communication in the suggested systems submitted. One authority proposes separate areas for landing and taking off, and stop-and-go lights at the head of the take-off runways. An airport engineer favors a visual system complete in itself and aural and radio signaling as auxiliaries. A system employing steam jets to be illuminated at night will be installed at an eastern airport. At another in the Middle West, it is proposed to install a panel of lights which will indicate the number of planes in the air at any particular time. Meanwhile a number of lighting companies and engineers are carrying on experimental work to solve this problem." The committee invites suggestions from all persons who may be interested.

NYRBA to Launch Miami-B.A. Service

NEW YORK (N. Y.)—That part of its route extending between Buenos Aires and Miami along the east coast of South America will be entirely placed in service by New York, Rio & Buenos Aires Line by Tuesday, Feb. 18, it has been announced. This initial operation will be for mail and express only, however, and will not include passenger accommodation until the schedules and various operating methods now set up have been seasoned by a period of practical operation. Sikorskys and Commodores are to be used.

The company has been extending its operation northward from Buenos Aires. The Buenos Aires-Montevideo line was extended to Rio de Janeiro on Jan. 8 to Sao Salvador on the 24th, to Fortaleza, Brazil, on the 27th and to Para at the mouth of the Amazon on the 31st. The company, through an associated concern, is operating between Buenos Aires and Santiago, Chile.

AIRPORT CONSTRUCTION PROJECTS

Central

A LOW BID OF $29,573.55 for a contract to lay additional sewerage at Lambert-St. Louis Field has been presented to the St. Louis Board of Public Service by the Riley Contracting Co., of St. Louis. It was the lowest of nine received and was 17 per cent under an estimate of the cost of drainage made previously by the city's engineers. Under the contract a sanitary sewer system will be laid at the airport and a small amount of storm drainage will be added. Entire cost of grading and draining the airport, including detouring of Cold Water Creek, will be about $325,000. Most of the work has been done.

Porterfield Aviation Interests, Inc., have leased the Falls City (Neb.) Airport for seven years at the rate of $560 annually. The Kansas City company is assuming all expenses of the field, and will maintain police and develop the port, which comprises an 80-acre tract of land a mile from Falls City. The company will also give a complete aerial service, including a flying school.

The Council Bluffs (Ia.) city council last week issued $40,000 airport certificates to acquire the 200-acre Dodge tract south of the city for a municipal airport, paying in full for the site. The council had previously authorized a one-mill tax levy for airport purposes, which will make available a total of $80,000 for estabishment and construction of the port.

Linden Airways, Inc., has acquired a five-year lease on a 100-acre port just outside the city limits of Columbus, Ohio. Construction on the improvements of the port will start within two months. A hangar with ten-plane capacity and cinder runways are included.

Fairfax Airport, Kansas City, has authorized the expenditure of $363,000 for improvements there this year. This will provide some new hangars, dormitories, additional sewage, garage, a bulk oil and gasoline station and a parking area.

The Chariton (Ia.) city council will vote Feb. 24, $25,000 bond issue for construction of a municipal airport. Option has been taken on a 300-acre site west of the city and if the bonds are authorized immediate work upon construction will be started.

The beacon and boundary lighting system at the Omaha Municipal Airport are ready for operation.

A 65-acre field has been selected for an intermediate field at Seward, Neb.

West

Cardiff & Peacock, Inc., of Bakersfield, Calif., have begun the erection of an aviation school and airplane sales agency at the Chandler Municipal Airport, Fresno. The hangar will be 60x125 ft., and will house six planes, school, office and shop.

The Yuma County Supervisors, of Yuma, Ariz., have let the contract to R. E. Hazard Construction Co., San Diego, for construction of two clay runways for the airport at Fly Field. About $20,000 is also available for hangar construction, lights and machine shops.

The city of Sheridan, Wyo., is making improvements to its airport, to include levelling, grading and draining, at a cost of about $20,000. E. C. Gwillim is city engineer.

A team of 25 business men has raised about $2,500 to apply to construction of a bulkhead along Mansfield (Ore.) mud flats which it is planned to convert into a municipal airport.

San Francisco is considering bids for enlargement of hangars Nos. 2, 3, and 4 at the municipal airport. Spivock & Spivock were the lowest bidders at $34,200.

The Fairfield (Ia.) city council is expected to act soon upon petition with more than 1,000 names asking for a special election to authorize bonds for construction of a municipal airport.

South

Improvements including runways, a hangar and proper field markings are to be made on the 160-acre Shamrock (Tex.) Airport. H. J. Ewton, automobile dealer, recently purchased the field from a group of five owners. Lights are to be installed after initial improvements.

Complete radio broadcasting and receiving equipment will soon be installed and the work of reconditioning the field will be begun immediately at Big Spring (Tex.) airport.

Intermediate fields at Belton, Georgetown, San Marcos, and Randolph Field —all in Texas—will be established and lighted by the government.

It is reported that city officials of Mobile, Ala., are planning to add lighting equipment to Bates Field, the municipal airport.

The Airport Committee of the Board of Commerce, Lexington, Ky., is soon to acquire an airport site.

Two hangars will be built at once at the Bogalusa (La.) Airport.

North Central

Radio receiving equipment for weather reports broadcast by the government in the Middle West has been installed at the Wold-Chamberlain Field office of Northwest Airways, Inc., Minneapolis. broadcasts are received principally from stations at La Crosse, Wis., and Chicago.

The Winnipeg Flying Club has proposed improvements to the Stevenson Airport in that city for the accommodation of seaplanes, improvements which include the construction of canals on two sides of the field allowing seaplanes to land from any direction. These canals will be 4,000 ft. long, 500 ft. wide and 6 ft. deep.

Hudson's Bay Co. is erecting a Neon tube beacon, said to be the largest in Canada, on the roof of the company's store at Winnipeg, Man.

Stout to Operate Austin Hanger

CLEVELAND (OHIO)—Stout Air Lines will take over and operate the $125,000 Austin hangar at Cleveland Municipal Airport March 1, Stanley E. Knauss, vice-president and general manager has announced. The big hangar will be used by the company as its Cleveland base for the passenger planes it operates between Cleveland, Detroit and Chicago. In addition it will be operated as a service depot for engines, carburetors, propellers, electrical apparatus and air navigation instruments. Day and night service to private and transient planes will also be offered. Austin is partitioning off the huge hangar to provide facilities for an overhaul shop, stockroom, oil room and space for storage of planes.

Airway Briefs

Daily amphibion passenger service between Los Angeles and Lido Isle, Newport Beach, has been inaugurated by Western Air Express, in connection with real estate developments at the resort.

Igor Sikorsky recently made an inspection trip of Pan American Airways' facilities in Florida.

W. C. Buetow, Wisconsin state highway engineer, recently gave a talk on airports to 1,000 commissioners, road building contractors, machinery and equipment men at the annual road school meeting at Madison.

A display of modern airport designs consisting of 142 drawings, including prize winners in a recent contest, will be a feature of the Buffalo (N. Y.) Show, March 22-29.

Closing of the municipal hangar at Port Columbus for the rest of the winter has been suggested by Mayor Thomas because of the high cost of heating, which amounted to $1,000 in December.

A total of 199 planes were registered at Jacksonville (Fla.) municipal airport during January, and 10,280 gal. of gasoline were furnished. Neither figure includes planes regularly operated from Jacksonville by Eastern Air Transport.

Greater Miami (Fla.) Airport Association is sponsoring Sunday airport inspection trips, open to the public, to familiarize people with the city's facilities for planes and seaplanes.

A recent survey by Crouse-Hinds Co. indicates that authorities at more than 200 airports are now making plans for installation of lighting equipment.

Orders for four Lockheed Vega planes have been placed by Mexican Corporacion Aeronautica de Transportes, and will be used to provide 13-hr. service between Los Angeles and Mexico City.

The headquarters building at Fairfax Airport, Kansas City, 140 ft. long with 75-ft. wings, will cost $25,000. The central part is two stories, and the wings one story high. (See AVIATION, March 23, 1929, p. 904).

FOREIGN ACTIVITIES

Expect to Increase English Appropriations

LONDON (ENGLAND)—Present indications are that the amount of money devoted by the government to civil flying in 1930 will be considerably greater than last year. Some of the projects which will require greater subsidy are: continuance and enlargement of the policy of flying boat development; assistance in the establishment of an airline to South Africe; experiments with lighter-than-air craft; grants for the encouragement of civilian flying.

Orders have already been given for several experimental types of multi-motored flying boats, according to recent report, to be nearly as large and to carry as much power as the Do.X. An experimental construction to determine the relative merits of similar monoplane and biplane flying boats is now being carried out by the Short company.

Most of the expenditure for airships will go to the enlargement of R.101, now in progress, and further experimental flights with the two large dirigibles. They are not expected to be put into commercial use this year, commercial plans being indefinite.

Grants to private flying clubs will probably be on a different basis this year: instead of regular subsidies, the clubs will probably receive a fixed amount, probably about $50 for each flying certificate issued. Incidentally, several of the smaller clubs have already merged with National Flying Services, and others are expected to. Expenditure on equipment for the Royal Air Force is expected to be about the same.

German Board to Probe Accidents

BERLIN (GERMANY)—Luft Hansa, the largest German air transport operator, is establishing an Air Board analogous to the Sea Boards, which in all marine countries conduct investigations of accidents occurring to ships. The Air Board is not an officially recognized institution yet and for the present will act only within the organization of the Luft Hansa. It is hoped, however, that later it will receive official recognition and be empowered to deal with all air accidents occurring in Germany. The board consists of a chairman appointed by the German Insurance Board, two flight experts chosen from the ranks of the Luft Hansa pilots and two other members appointed from the general staff of the company. The board will be convened whenever an accident happens. It will reconstruct the order of happenings and investigate into the causes. It will be empowered to withdraw the certificates of pilots.

Mexico Names Airports of Entry

MEXICO CITY (MEXICO)—Hereafter all international air service entering this country must be operated through ten airports recently designated as ports of entry. Immigration, sanitary, and customs officials will be stationed at each of them to make the necessary inspections of incoming planes, passengers and goods. The airports named are at the following cities: Matamoros, Nueva Laredo, Piedras Negras, Ciudad Juarez, Nogales, Mexicali, Tia Juana, for the northern border; San Miguel de Cozumel, for the Quintana Roo coast; Profreso, Yucatan, for the Gulf coast; and Mariscal for the Guatemala border on the south.

London-India Line Operated on New Route

LONDON (ENGLAND)—Imperial Airways mail and passenger service between London and Karachi, India, is to follow a new route as a result of disagreement with the Italian authorities who have been co-operating in the operation of the Mediterranean section of the line. Hereafter the route will be Croydon - Cologne - Nurenburg - Vienna-Budapest - Belgrade - Uskub - Salonika - Athens-Crete-Alexandria. Formerly the route itinerary was through Switzerland to Genoa and across the Mediterranean to Alexandria by flying boat with several stops at Italian points of call.

As the route between Cologne and Athens is unflyable at this time of the year, the present arrangement is to carry the mail by air to Cologne, by train to Athens and by flying boat to Alexandria. One of the causes of the disagreement with the Italian government was the Italian demand to pool the income and take half of the revenue not only between Europe and Egypt but also to India.

German Air-Boat Plan Progresses

BERLIN (GERMANY)—Herr Wronsky of the Luft Hansa Board of directors has announced again that the company plans to inaugurate an air-boat mail service between Europe and South America some time this year. Mail will be carried in boats between the CanaryIslands and Fernando Noronha similar to the French service. This announcement follows the recent test flight between Germany and Spain and the Canary Islands with an Arado mail plane. If the contemplated dirigible service between the two continents is instituted, planes will be used to distribute the mail from the terminal points of the Atlantic crossing.

German Industry Experiences Slump

BERLIN (GERMANY) — The situation in the German aircraft industry is reported to be exceedingly bad, and it is likely many of the aircraft factories may close down altogether in the course of the year. The Reichstag, in order to carry through an economy program, already has demanded that the number of manufacturers receiving government grants be reduced and has requested the Transport Minister to select a few of the most successful plants for future support to the exclusion of the others. The Transport Minister selected the following: Junkers, Dornier, Heinkel and Bayerische Flugzeugwerke as builders of transport and school planes and Bayerische Motoren - Werke, Junkers and Siemens as makers of engines. These will receive between them about $1,440,000, which have been voted with the budget.

Last autumn the German builders of transport planes were given between them $2,160,000. This sum was at first granted as a loan but afterwards converted to a grant without any counter service being required for it. For those not selected in the group above this was a final donation from public funds, and it was suggested to them to use the money for re-organizing their plants and taking up other branches of production to support themselves.

Optimism Ill-founded

These manufacturers, of course, are loath to change their production lines and hope the outlook for them will become better. But it is more likely to become even worse in the course of the year. Their hope lies in bringing out a new type of plane of exceptionally good performance. The Luft Hansa would be free to purchase their machines in such an event. There are beside the Luft Hansa several small regional airline companies, but their demand for new aircraft is small.

The export possibilities are no more promising. Every country, naturally, supports its own industry and thus there is little possibility of a good export market developing. The makers of German sport planes are no better off than those of the larger machines because as yet the number of private individuals purchasing such craft is small.

The Rohrbach company is reported to be on the verge of bankruptcy. November wages and salaries were not paid until Dec. 20 and this was made possible by grant of $240,000 by the Transport Minister. December wages and salaries have not been paid yet, it is reported, and further assistance from the government is being withheld.

Glider Association In Germany Reports

BERLIN (GERMANY) — The Rhon-Rossitten Gesellschaft, the central gliding organization in Germany, which undertakes the training of glider and soaring pilots, has just presented the report of its 1929 activities. The society has two air sailing grounds, one in the Rhon hills, in the south of Germany, and the other on the dunes of the Baltic at Rossitten, East Prussia. In the Rhon camp 269 pupils were trained last year. Of these, 139 passed the "A" test, 121 the "B" test and 30 the "C" test. About 450 starts were made. In the previous year 152 pupils were trained so that the growth amounts to over 77 per cent.

At the Rossitten camp eighteen courses were held in the time from April to the end of October, 1929, and 303 pupils were trained as compared with 176 the previous year, which means a growth of over 72 per cent. A new flying ground has been discovered in the neighborhood of Rossitten at Pillkoppen, where more favorable winds blow, enabling a larger number of pupils to be trained. On the old ground schooling depended too much on east winds. These prevail especially during the winter months and for this reason it has been decided to start schooling very early this year, probably in February.

Of the 572 pupils trained in 1929, the majority were college students and teachers. Several plane pilots and several foreign pupils were trained. In general the flying conditions in this camp are more easily mastered than at Rhon. "A" tests are no longer continued as they are too easy. The "B" and "C" tests, the former for gliding and the latter for soaring, have been made more difficult. In order to obtain the "B" certificate the pupil has to carry through five one-minute glides.

Harkness Develops Australian Aero Engine

SYDNEY (AUSTRALIA)—Bench tests on the Harkness Hornet, first aviation engine to be designed and produced in Australia, are held up pending the completion of a new Civil Aviation Department wind tunnel at Randwick. In preliminary tests, the engine developed 105 hp. at 1,950 r.p.m. It is designed for 110 hp .at 2,000 r.p.m. Don Harkness, of Harkness & Hillier, Ltd., who designed the engine, expects to put it into production as soon as it is approved by the Civil Aviation Department.

The engine incorporates several novel features, among them the fact that the four cylinders in line are cast in one block of aluminum, complete with cooling fins and integral with the upper half of the crankcase. Steel liners are used in cylinders. The engine also provides for oil cooling in an oil radiator which surrounds the intake manifold. The bore is 4.82 in. and the stroke is 5.218 in. The camshaft is overhead, operating two valves in each cylinder.

Foreign Briefs

The closed circuit non-refueling distance record established Dec. 17 by Costes and Codes has been homologated by the F.A.I., with the distance set at 4,990.33 mi.

New flying boats now being built for the British Royal Air Force are designed for a range of 2,500 mi. with full load.

Negotiations are said to be under way for licensing the Junkers company to produce Wright engines in Germany.

A gliding congress will be held March 8-10 at Darmstadt, Germany.

M. Auguste Rateau, inventor of the supercharger bearing his name, died Jan. 13, at the age of 67.

Ateliers Breguet has built a new helicopter designed by M. Dorand, and flight tests will be made soon.

Focke-Wulf Aircraft Co., Bremen, Germany, has produced a new six-passenger transport plane with a special airfoil design.

Turkish Aircraft & Motor Co. factory is being completed, and production of Junkers planes, for which the company is licensed, will begin soon.

A plane similar to the G-38 is being built in Japan under Junkers license, but reports that the G-38 has been sold to Japan are denied, since it was built to the order of the German Transport Ministry.

Usborne Memorial prize for 1929 has been awarded to F. G. Evans by the council of the British Royal Aeronautical Society for his paper on "The Cross-Section of the Semi-Rigid Airship."

Raab-Katzenstein Airplane Construction Co., Kassel, Germany, has suspended operations because of financial difficulties due to the failure of a local bank.

F. W. Carey recently made a tour of the Far East, particularly Malaya, in the interests of Fairey Aviation Co.

Air Force is the new name adopted by the official organ of the Ligue International des Aviateurs. It is published monthly and contains articles in English, German, Spanish, etc., as well as French. The first number was January, 1930.

The Peruvian Minister of Marine and Aviation has announced that the government's proposed purchase of airplanes will be made in the United States.

Corporacion Aeronautica de Transportes, S. A., Mexico, has issued credential cards for commercial travelers, giving them 25 per cent reduction from regular one-way fares.

A new airport has been established at Guasave, Mexico, which is on the Pickwick Latin American Airways Los Angeles-Mexico City line, and on the Matamoros-Matzalan line of Aeronautical Transport Corp.

K.L.M. Reports '29 Record of Operations

ROTTERDAM (HOLLAND)—Considerable increase in the use of three-engined planes is indicated by the operations figures for K.L.M. in 1929. Total hours flown in three-engined machines was 3,161, as compared with 538 the previous year. Hours flown in single-engined machines during 1929 were 8,762, as compared with 9,163 in 1928. The total amount of flying in machines of all types was thus increased from 10,287 hr. to 12,414 hr. The line uses Fokker planes exclusively.

Titan engines are beginning to replace Jupiter engines in K.L.M. planes, increasing in number of hours flown from 1,751 to 10,050, while hours flown with the Jupiter engines decreased from 14,102 in 1928 to 13,730 in 1929. In 10 yr. of flying, K.L.M. planes have amassed a total of 61,051 flying hours, with 82,538 engine hours, and distance of over 5,300,000 mi. covered.

Mail was carried by K.L.M. on fourteen trips between Amsterdam and Batavia last year, with only one forced landing. The plane was not seriously damaged, and mail was delayed only five days. On the other thirteen trips, the mail was delivered in every case within fourteen days from the start, and several times in eleven days. The distance is about 8,000 mi., most of it over difficult territory with few intermediate landing fields ready for use.

Further Light Plane Tour Plans Announced

BERLIN (GERMANY) — Detailed regulations for the 1930 International Light Plane Tour (Challenge International de Tourisme) are to be published this month. The Italian Aero Club, has announced that it will not enter, as a protest against the conduct of last year's tour. The Italians claimed that some of the prize-winners should have been disqualified for flying over prohibited areas in Italy, but after investigation the claim was disallowed.

The following will take part: Germany (Aero-Club von Deutschland), Spain (Federacion Aeronautica), Great Britain (Royal Aero Club), France (Aero-Club de France), Poland (Aeroklub Rzeczypospolitej Polskiej), Switzerland (Aero-Club Suisse), Czechoslovakia (Aeroklub Republiky Ceskoslovenske).

The contest is to take place on July 20-Aug. 7. The route is as follows. Berlin, Brunswick Frankfort, Reims, St. Inglevert, Bristol, London, Paris, Poitiers, Pau, Saragosse, Madrid, Sévilla, Barcelona, Nimes, Lyon, Lausanne, Bern, Munchen, Wien, Prague, Breslau, Cracovie, Warsaw, Koenigsberg or Dantzig, Berlin. The total distance is about 4.660 mi. with 28 compulsory stops. The Channel is to be crossed twice and high mountains, such as the Pyrenees, are included.

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A.T.C. 242. Fairchild "42." Custom Foursome, for business executives and sportsmen. Equipped with Wright J-6 300 h.p. engine. Dual controls. Inertia starter. Folding wings, top speed 130 m.p.h., climb 700 feet per minute. Service ceiling 15,300 feet. Price $12,900 flyaway Farmingdale.

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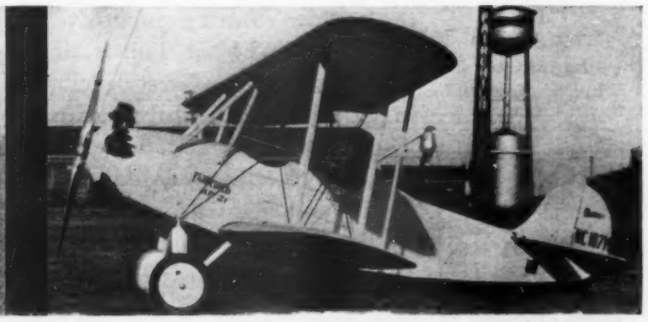

A.T.C. 215. Fairchild KR-21. Two place, tapered wings, for training and sport. Equipped with 90 h.p. Kinner engine. Top speed 113 m.p.h., climb 775 feet per minute, loaded. Service ceiling 15,000 feet. An unusually maneuverable ship. Price $4,685 flyaway Hagerstown, Md.

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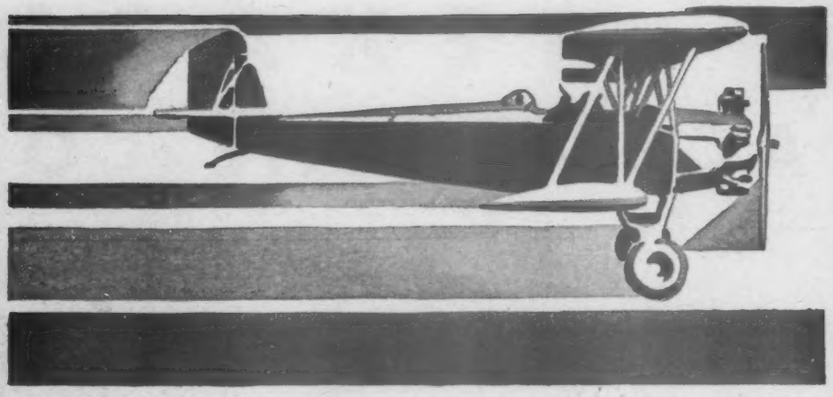

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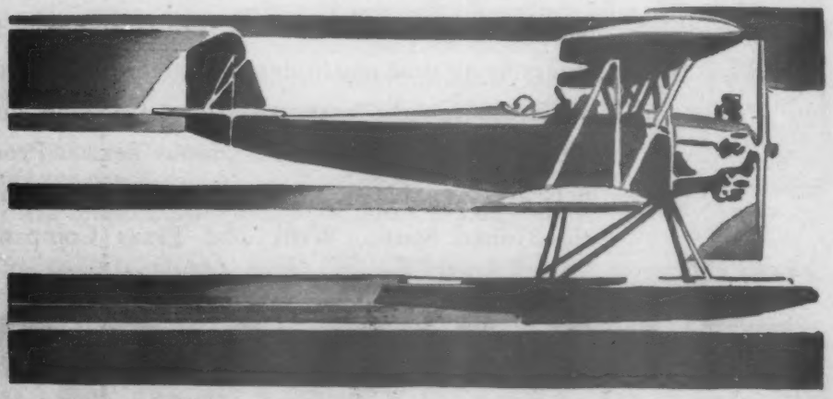

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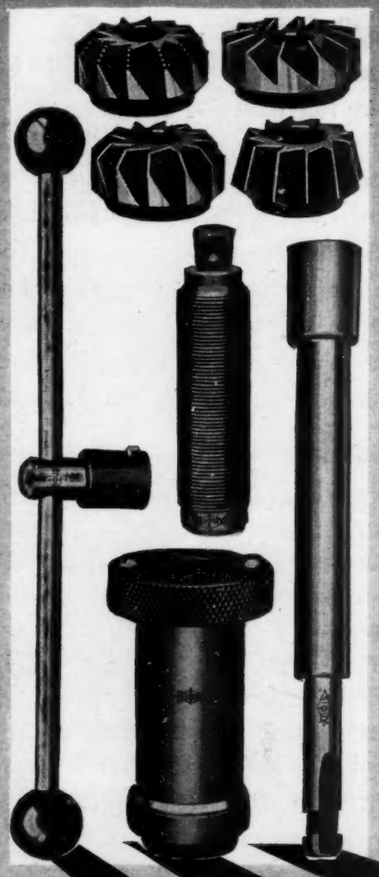

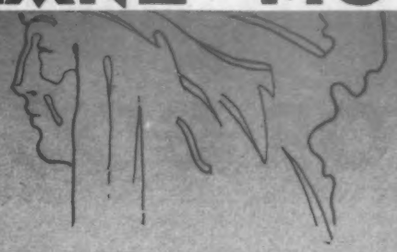

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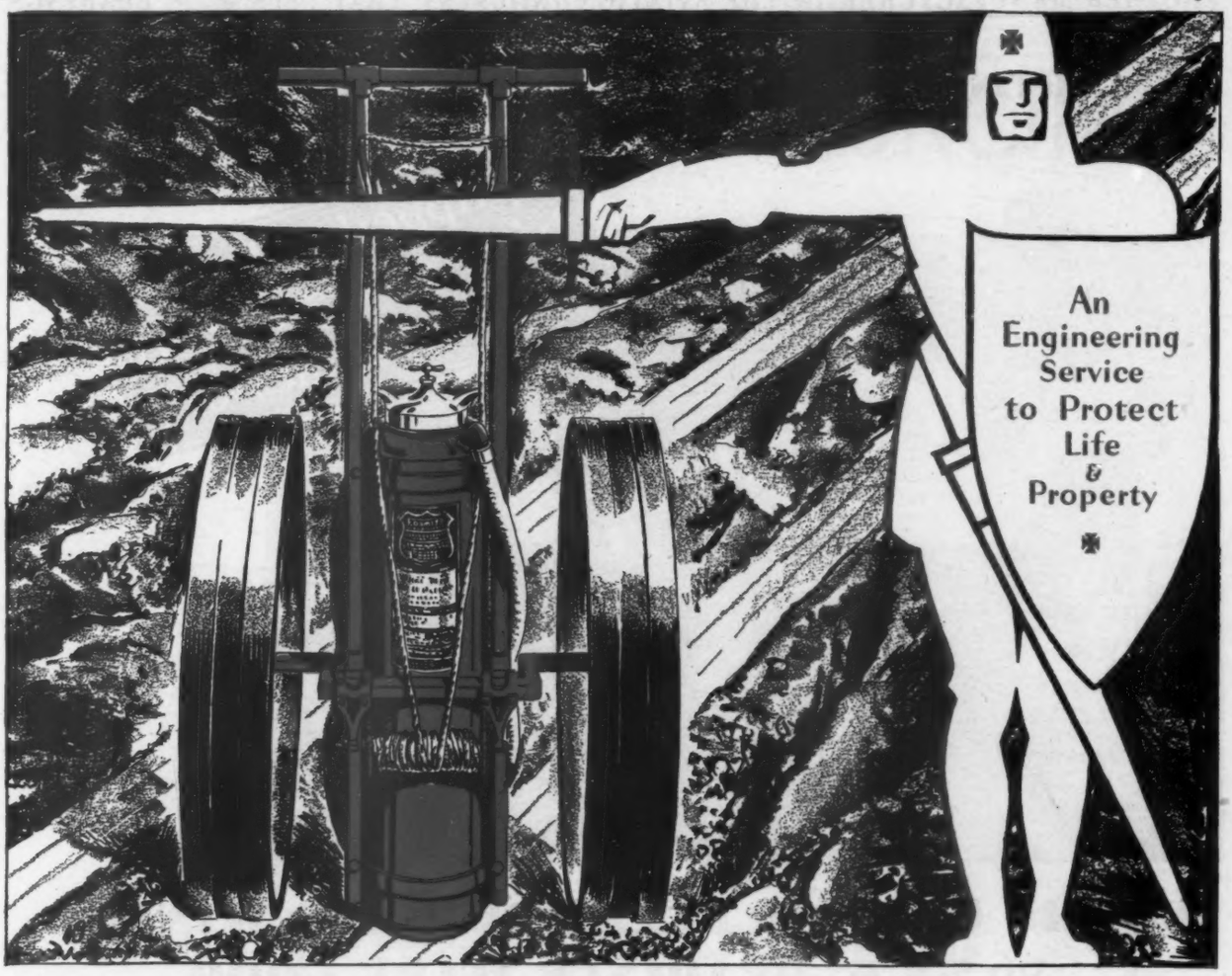

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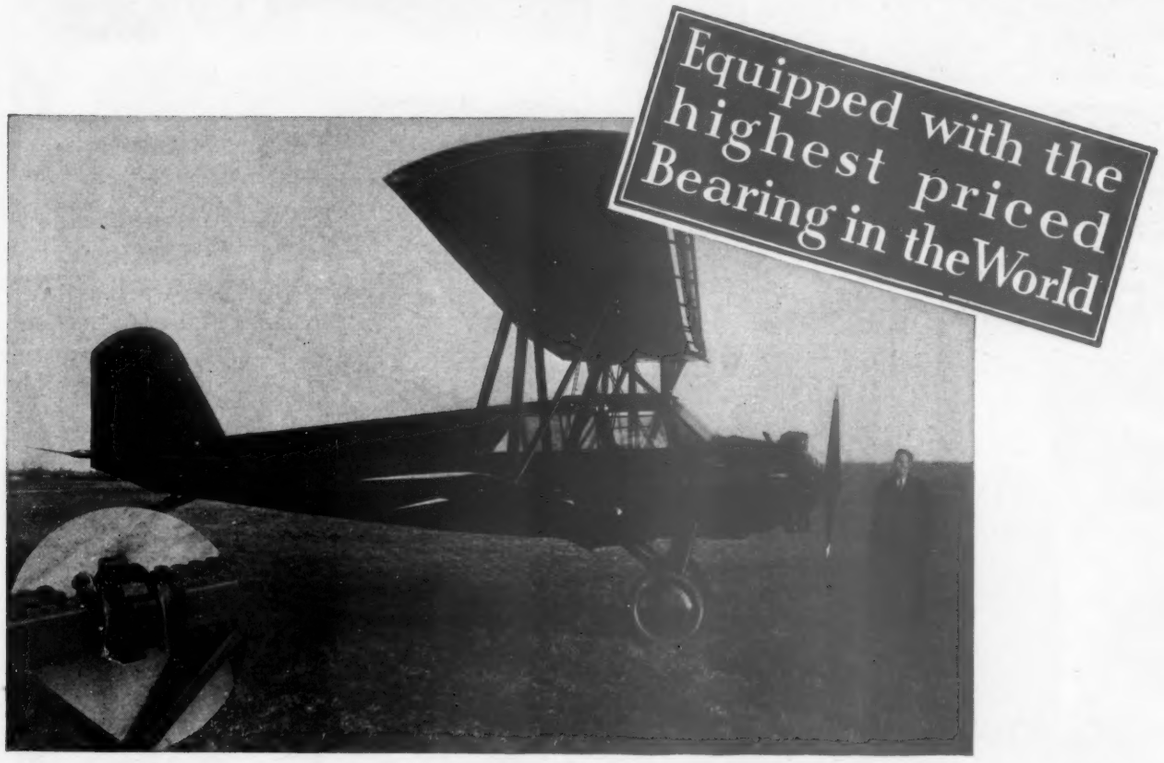

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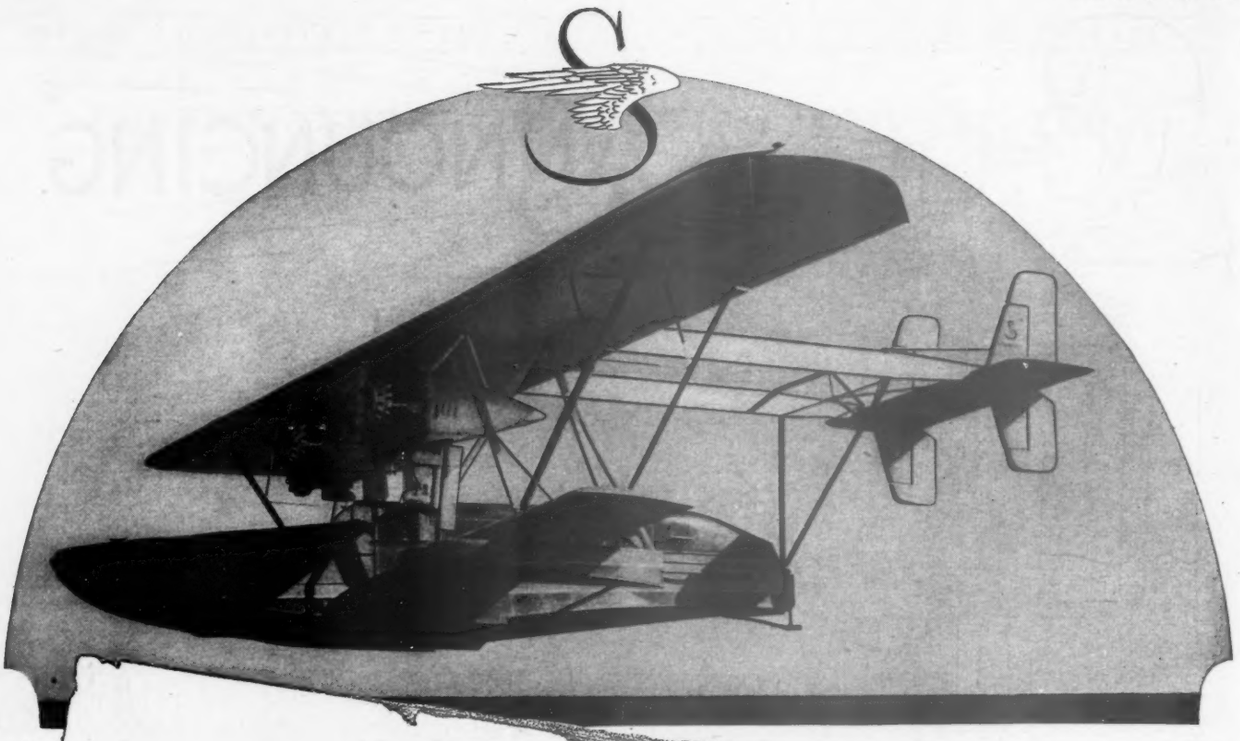

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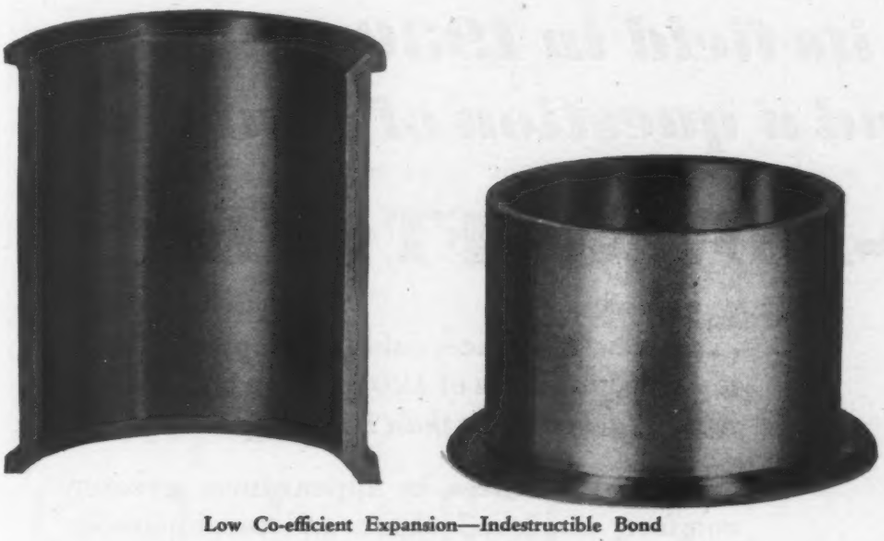

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The development of this type of bearing constitutes one of the outstanding achievements for the advancement of Aero-Motive engineering

ALLISON ENGINEERING COMPANY

INDIANAPOLIS

To Dominate

its field in 1930
beyond a question of doubt

MONO-AIRCRAFT *Offers*

. . . a new two place, cabin monoplane with a top speed in excess of 120 miles an hour (*—yet with a fuel cost less than 1½ cents per mile*).

. . . new smartness in appearance, greater comfort, improved vision and incomparable stability.

. . . a new 90 horse-power engine, second to none in the world for dependability, accessibility, simplicity and economical maintenance. (*We will supply a kit of five cylinder barrels, pistons with rings fitted, valve guides, rocker arm bushings, gaskets and spark plugs for $75.00 list.*)

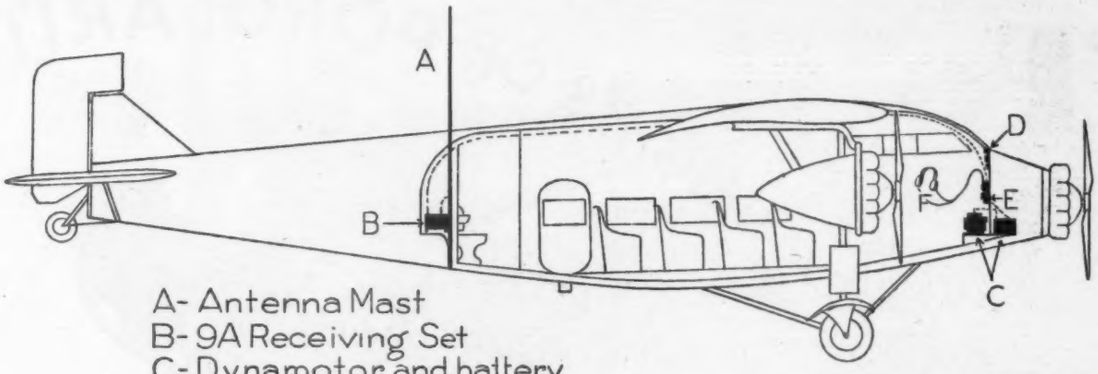
. . . complete accessories contributing to added safety such as brakes, steel propeller, parachute pack seats, air speed indicator and the best instruments money will buy.

. . . a price as usual below anything else in the field.

Nineteen Thirty Will Be a
Mono-Aircraft Year

Full information is yours for the asking.

MONO-AIRCRAFT CORPORATION
MOLINE, ILLINOIS



Compact . . . . Easily Installed . . . . Accessible . . . .

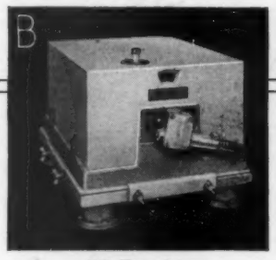
Western Electric Radio Telephone Receiver designed for maximum convenience

Western Electric's radio telephone receiver may be installed in any part of the plane, with remote tuning and volume controls conveniently placed on the pilot's instrument panel. Ease of operation is assured under all flying conditions.

The receiving set (measuring 9⅞" x 12⅜" x 6" and weighing but 17 pounds) may be removed from the plane for inspection, transferred to another plane or used on the ground by simply loosening four wing nuts. All parts are readily accessible. Power supply by dynamotor operating from plane battery or wind driven generator.

With the airplane radio telephone receiver the pilot "flies the beacons" when darkness, fog or clouds obscure his view of the ground. He receives instructions and weather reports from airports along his route, enabling him to make decisions of vital importance based on accurate information.

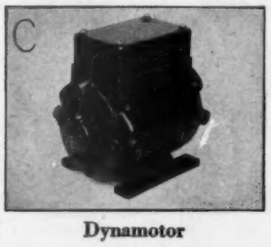
And with Western Electric transmitting apparatus also installed in his ship he has communication facilities which enable him to make contact with dispatchers or other pilots in flight. For full details write to Western Electric Company, Department 244A, 195 Broadway, New York, N. Y.



9A Receiver

Remote Tuning Control

Remote Volume Control

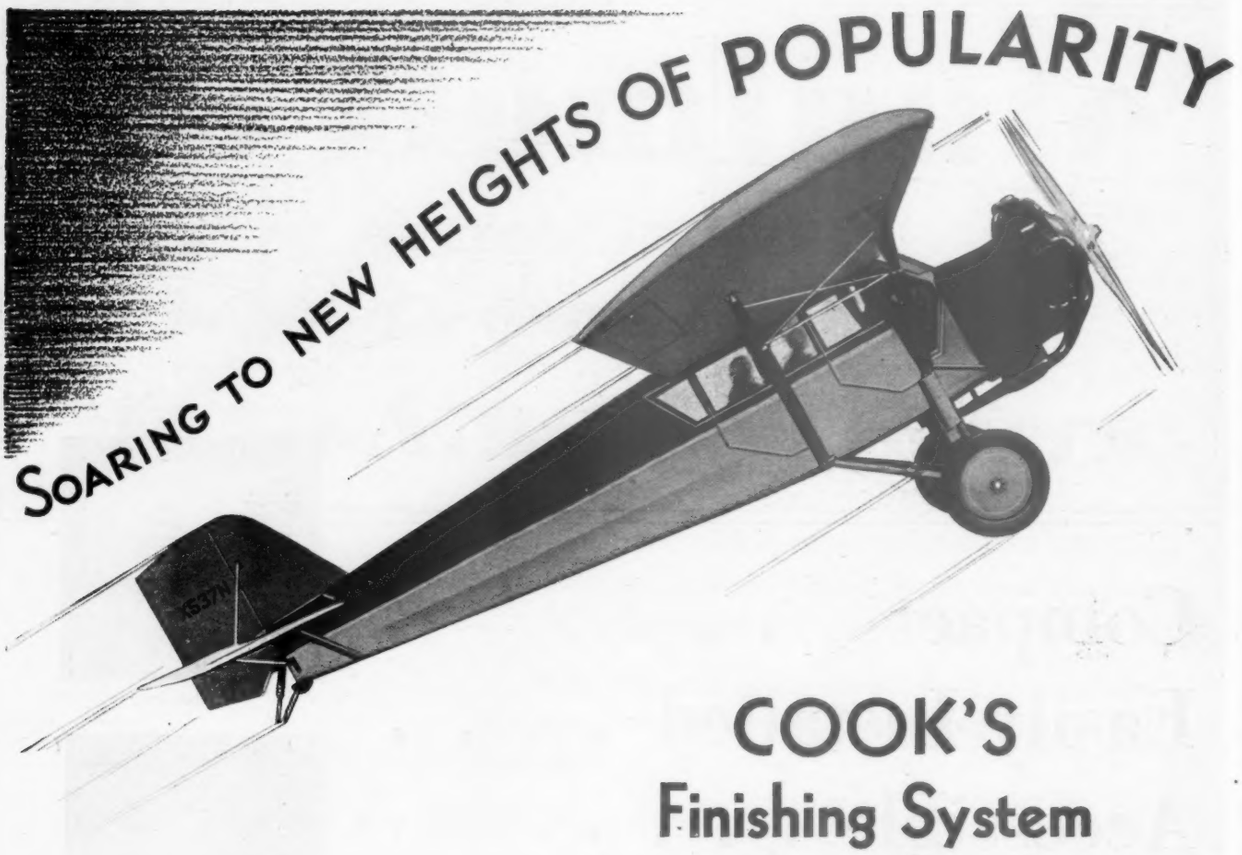


Dynamotor

Western Electric

Aviation Communication Systems

MADE BY THE MAKERS OF YOUR TELEPHONE



COOK'S
Finishing System used on the new
3-PLACE ROBIN

A THING of durability and beauty is this new 3-place model of the famous and popular Curtiss Robin. It was only natural that in the interest of *durability* and *beauty* the famous and popular Cook's Finishing System was used on this ship.

Cook's makes a very superior finish for every 'plane and airport need, including dope-proof primers and varnishes, as well as a complete line of pigmented and semi-pigmented dopes.

Write for the complete Cook's Finishing Plan.

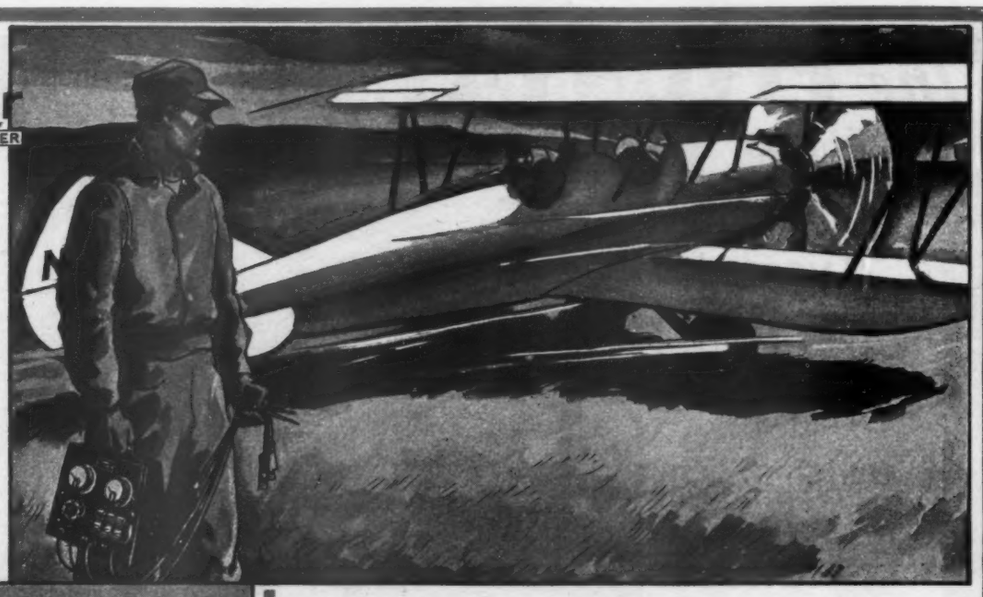
COOK'S PAINTS

COOK PAINT & VARNISH COMPANY

Aviation Division: No. 2426 North Broadway, St. Louis, Mo.

FACTORIES AT KANSAS CITY, ST. LOUIS, FORT WORTH, HOUSTON, CINCINNATI AND DETROIT

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER



$39* "Accurate As A Watch, Rugged As A Wrench"

You're SURE and so is the pilot

If you've checked her over with a G-E Tungar Battery Tester

Is the generator okay? Battery ready for its full job? Wiring all good? How's the starter?

You can be *sure*—with a G-E Tungar Battery Tester. You spot a ship's electrical troubles *before* anything happens.

This all-around tester is quick and easy to use in the hangar or outdoors. At every overhaul . . . top or general—before every flight, even—it adds another degree of safety.

And it's dependable—typically General Electric—so rugged that its fine accuracy is permanent.

The G-E Tungar Battery Tester is from the same research laboratories that gave aviation the General Electric supercharger, depth finder, radio beacon, engine temperature indicator, electric gasoline gauge and much other equipment for flying.

Another General Electric contribution toward safety in air.

G-E TUNGAR BATTERY CHARGER

Protect Batteries

Charge them at the field—*under your own eye*—with a Tungar. It doesn't burn them up. Simple to operate—in any shop corner. Three sizes—$45*, $75*, $135*.

G-E PORTABLE HAND LAMPS stand the gaff!

G-E FLEX ALL-RUBBER CORD SETS

keep shop equipment working.

*Prices net east of the Rockies

G-E Merchandise Distributors everywhere can supply you.

GENERAL ELECTRIC

MERCHANDISE PRODUCTS

Use the Coupon

Section A-192, Merchandise Dept.,
General Electric Co., Bridgeport, Conn.

Please tell me about:—

___G-E Tungar Battery Tester
___G-E Tungar Battery Chargers
___G-E Portable Hand Lamps
___G-E Flex All-Rubber Cord Sets

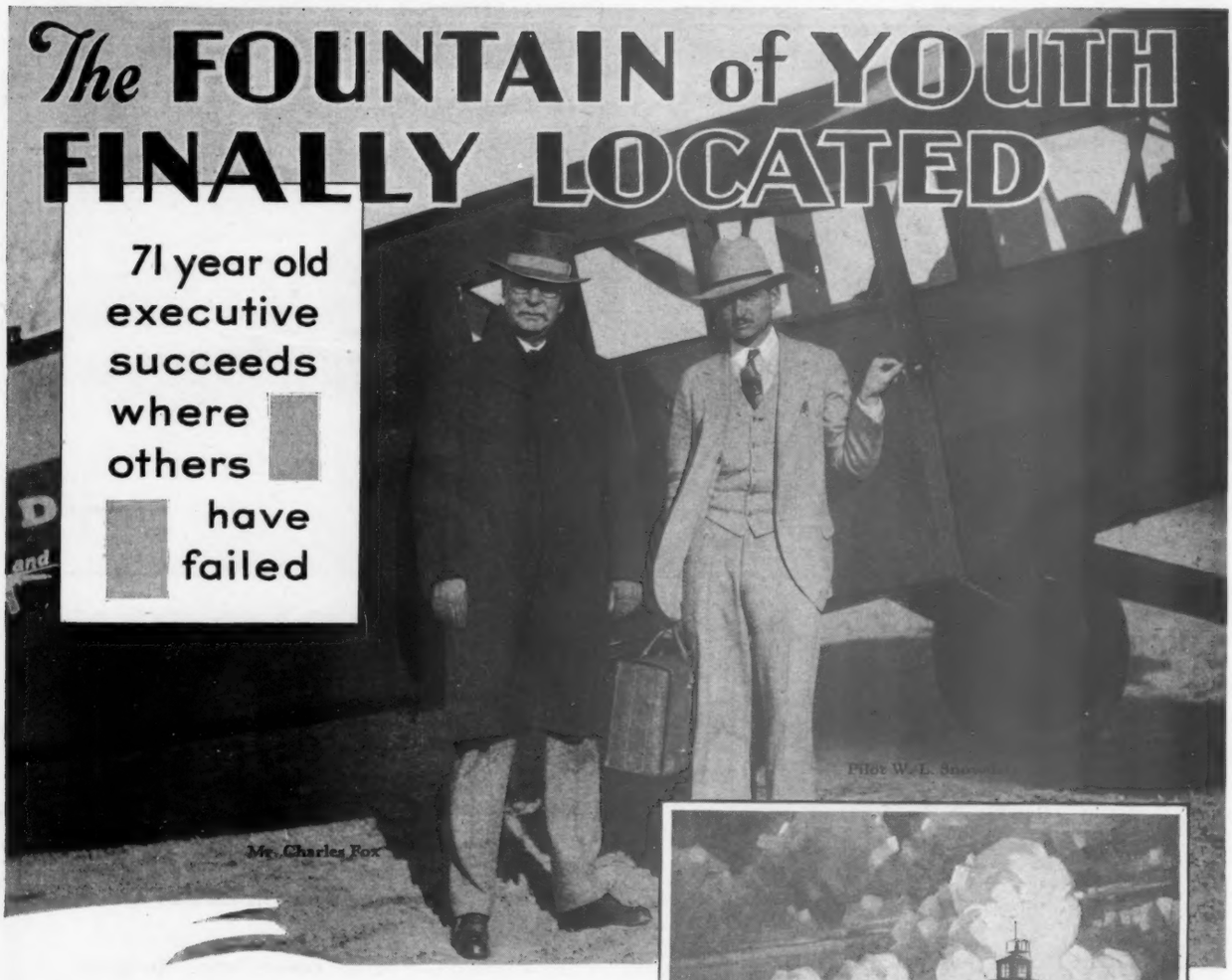
Name_____

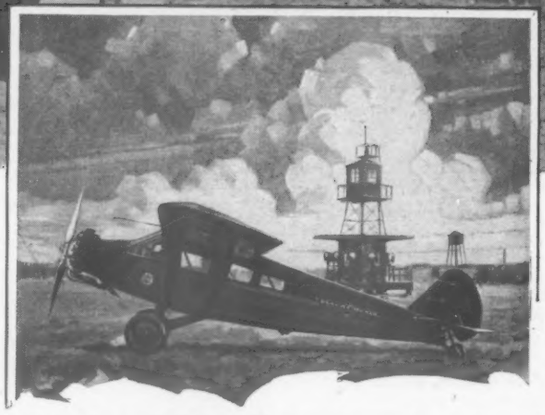
Address_____

MERCHANDISE DEPARTMENT : GENERAL ELECTRIC CO. : BRIDGEPORT, CONN.

The FOUNTAIN of YOUTH FINALLY LOCATED

71 year old executive succeeds where others have failed





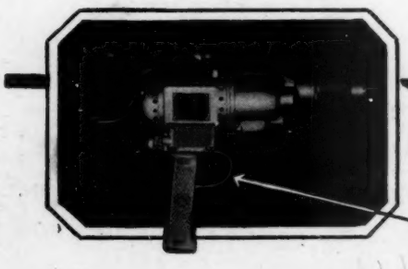
Mr. Charles Fox, a Vice-President of The Black & Decker Mfg. Co., advises that he has found Ponce de Leon's "Fountain of Youth," for which intrepid explorers have searched for hundreds of years. Mr. Fox says that every one else has been looking for the famous fountain on the ground, whereas he has discovered it to be in the air.

Mr. Fox left Baltimore in the Black & Decker "ship" in January, intending to make a brief "hop" to Richmond, Va. It was his first trip by plane and was in the nature of an experiment. The plane was scheduled to call at 36 airports in a thirty days swing through Virginia, North Carolina, South Carolina, Georgia, Florida, Louisiana, Arkansas, Alabama and Tennessee, for contact and investigation work in connection with the supplying of electric tools and equipment developed to meet the specialized requirements of The Industry.

Instead of a two-hour flight as planned, Mr. Fox stayed with the "ship" for the entire trip.

(In the course of the trip this "ship" won several prizes at the Miami Air Meet.)

The Black & Decker Mfg. Co. takes this opportunity of expressing appreciation of the hearty reception accorded the plane everywhere it has called, and for the enthusiastic co-operation extended to its representatives.



The BLACK & DECKER MFG. CO.

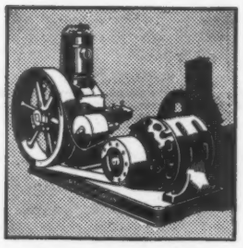
TOWSON, MD.

Slough, Bucks., England — Toronto, Ontario, Canada

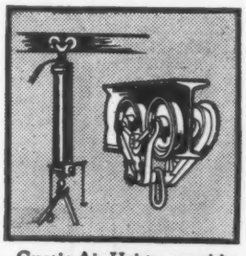
"With the Pistol Grip and Trigger Switch"

See the exhibit of
CURTIS *Air Equipment*

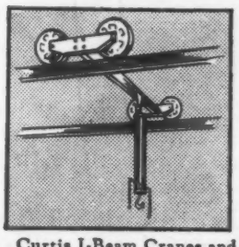
at the International Aircraft Exposition in St. Louis - Feb. 15 - 23



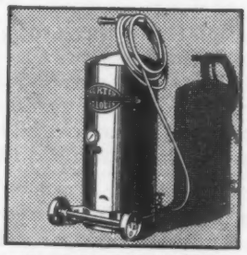
Curtis Compressors are ¼ to 50 H. P. with capacities up to 250 cu. ft. per minute.



Curtis Air Hoists, capacities from ½ ton to 10 tons.



Curtis I-Beam Cranes and Trolleys, 10 to 40 ft. span and ½ to 10 ton capacities.



Curtis Portable Air Tank—For taking air out to a plane away from the usual source of supply.

JUST as compressed air has long helped automotive industry, it is now helping the aviation industry to get greater production at less cost.

A visit to the Curtis exhibit of compressed air equipment at the International will be of inestimable value to executives who want to learn more about

How compressed air speeds up airplane production and servicing

CURTIS TIMKEN EQUIPPED COMPRESSORS —providing air for spray painting, spraying dope on the wings, tire inflation, charging shock absorbers, spray cleaning engines, spraying of grease solvent or paint removers, air drying of parts dipped in cleaning solutions, blowing out dust, chips, etc. at benches and drill presses; power for operating air hoists, riveters, pneumatic drills, sand blasts, pneumatic water systems, etc.

CURTIS AIR HOISTS—Power hoists at little more than the cost of chain blocks. Used with a Curtis I-Beam Trolley or Crane, they can serve a wide floor area. Used for lifting engines out of fuselages, mounting engines, and other parts, and many other purposes where a combination of power, speed and accuracy is a factor of economy. Because there are no delicate mechanisms, even unskilled laborers can operate Curtis Hoists without danger of throwing them out of commission.

CURTIS AIR TANKS—Portable tanks for taking air out to a plane away from the usual source of supply. Stationary tanks for use with compressor unit in the shop, also separate tanks for mounting on service trucks.

The Curtis Pneumatic Machinery Co. was founded in 1854 and is, therefore, in its 76th year. Three-quarters of a century of successful business existence can be explained only by integrity, sound policy and financial strength to permit the extensive development and research work necessary to keep our products in advance of competition.

CURTIS
Pneumatic Machinery Co. St. Louis

1954 Kienlen Ave., St. Louis 5518 AF Hudson Terminal, N. Y.

Write for Catalog C-76 and for any specific information you desire in connection with the use of air equipments in airports and airplane factory work.

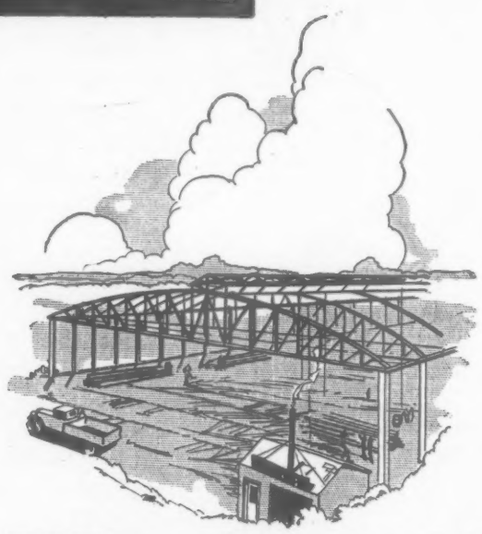
ROBERTSON *shares its* HANGAR BUILDING *experience*

WITH LOCAL ARCHITECTS . . . .

WITH LOCAL CONTRACTORS. . .

WITH PUBLIC OFFICIALS . . . . .

WITH AIRPORT CONTRACTORS. . .



ROBERTSON

WORLD WIDE HANGAR BUILDING

EXPERIENCE

IF YOU are an architect and are called upon to design a hangar or hangars, the Robertson Company will be glad to consult with you on the technical phases of the job.

If you are a contractor and wish to bid on local hangars, the Robertson engineers will give you facts on costs, labor, the experience record of various materials, et cetera.

If you are a public official and have to consider the natural claims of local firms on the airport contracts, the Robertson Company will be glad to enter a working arrangement with these firms to handle the specialized problems growing out of aviation's individual needs.

If you are an airport contractor, the Robertson engineers will take over for you general divisions of the work, or handle such specialized problems as adequate daylighting and ventilation of the hangars.

By calling in Robertson, you can command the most complete collection of engineering and construction experience in the whole field of hangar-building. Robertson engineers have had a part in the construction of hangars all over the world, since the days of the war, for all kinds of uses, and over the whole range from small plane hangars to the greatest building in aviation's history . . . the Goodyear-Zeppelin airship factory and dock at Akron.

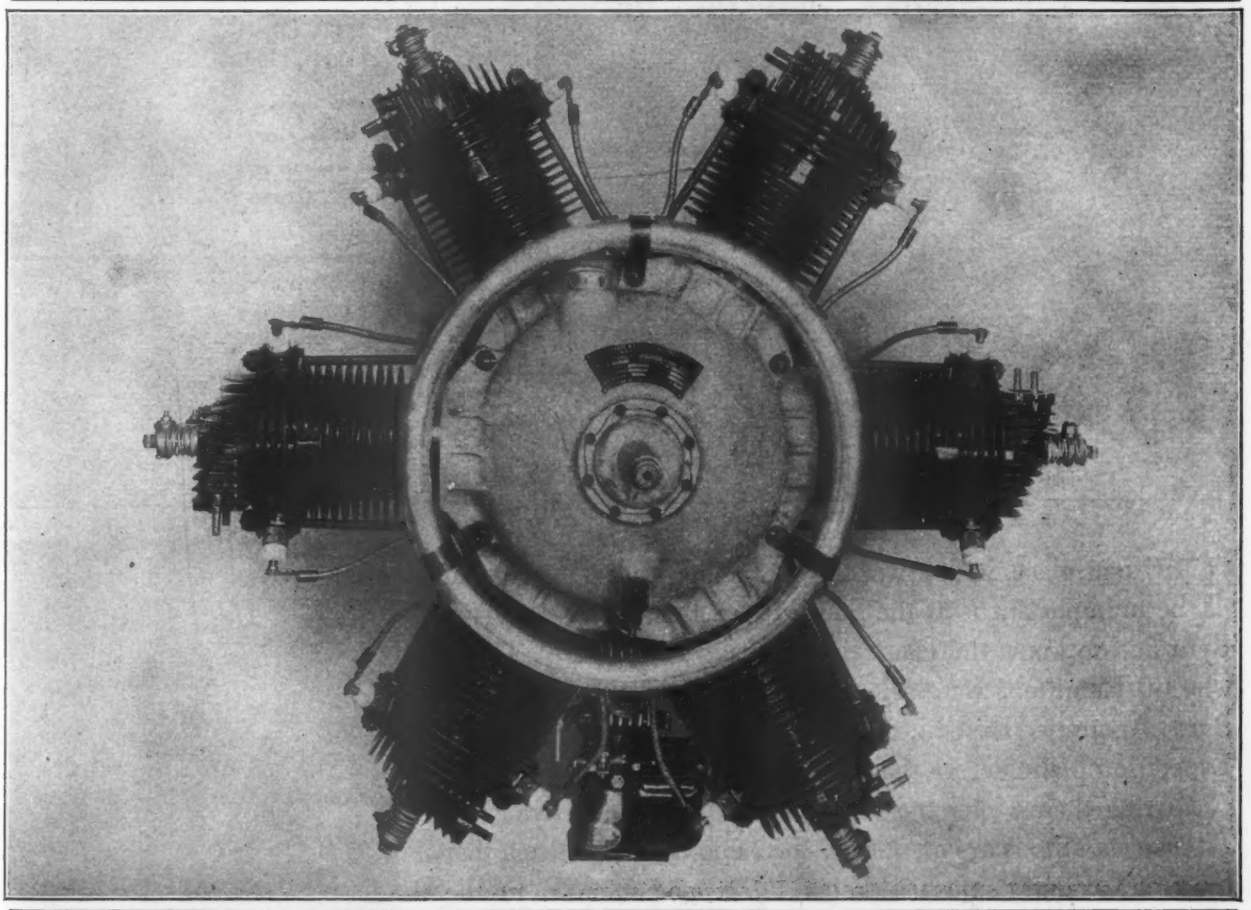
Write direct to the Pittsburgh office.

H. H. ROBERTSON COMPANY
PITTSBURGH, PA.

Brownback C400

TIGER

SMOOTH, VIBRATIONLESS POWER



DEPARTMENT OF COMMERCE APPROVED TYPE CERTIFICATE No. 33

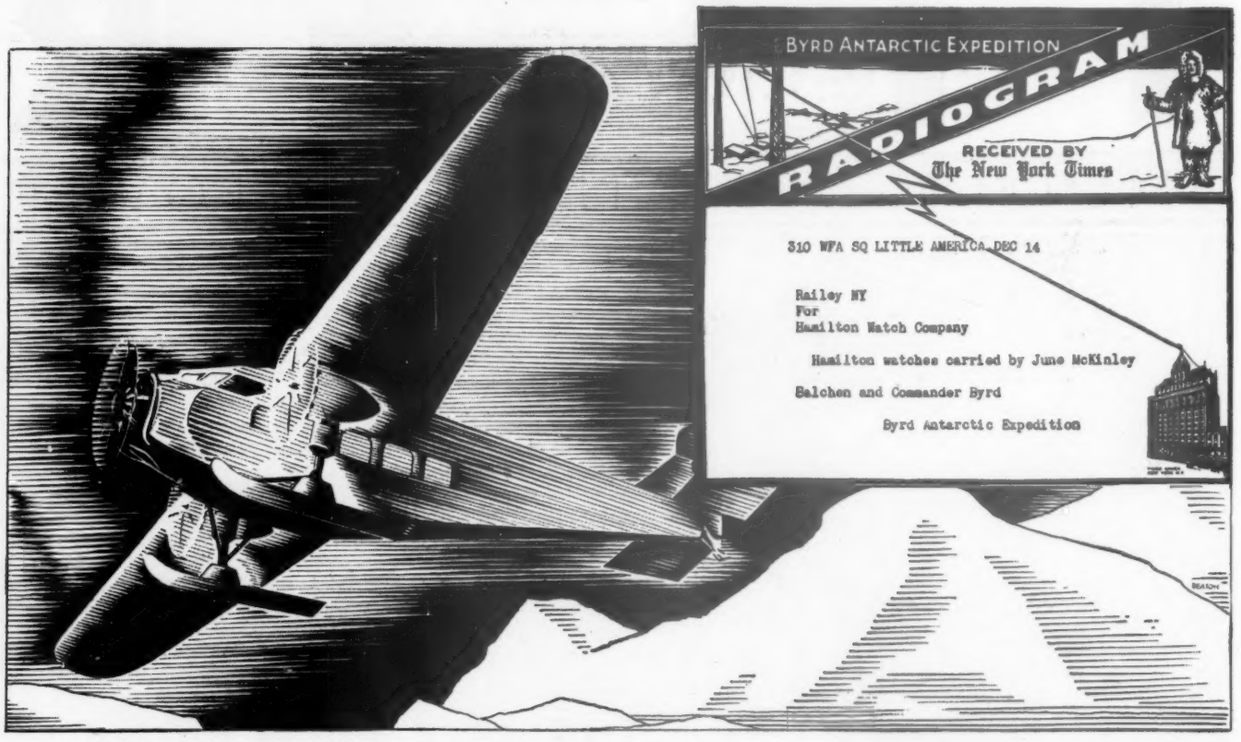
THE Light Manufacturing and Foundry Company announces the Brownback "TIGER"... a new aircraft engine which delivers smooth, tireless vibrationless power for a greater number of hours in the air than has heretofore been possible.

Correct design and sturdy construction mean more flying hours at lower cost

The first cost is low—the maintainance cost is almost unbelievably small. Complete simplicity of construction, the accessibility of all parts and the ease of servicing reduce inactive hours and repair costs to the very minimum. The Brownback "TIGER" will break all records for economical operation and sustained service over long periods of time. It develops its 90 h. p. at an extremely low r. p. m., reducing vibration and engine-strain. This is a particularly serviceable engine for training or instruction planes. Weight is less than 3 Lbs. per h. p.

Write for descriptive literature which contains a complete description of the distinctive design of the "TIGER" engine. A "TIGER" engine has been installed in our Demonstration Plane and we will be glad to arrange a thorough demonstration of this revolutionary aircraft engine in the air. See us at the International Aircraft Show, St. Louis. Aeronautical Division, LIGHT MANUFACTURING & FOUNDRY CO., Pottstown, Pa.

Where minutes mean miles and miles mean life or death!



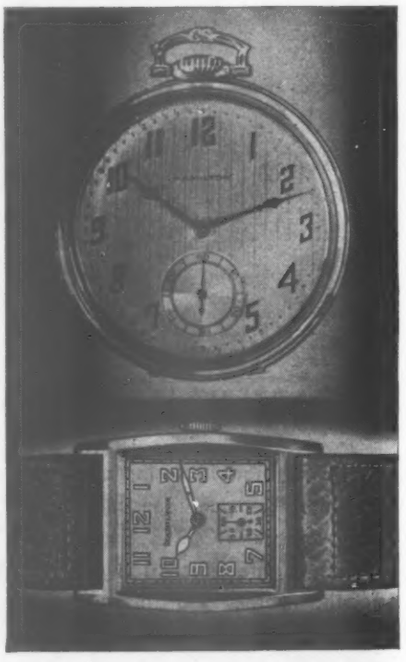
THE one place in the world you might think Time would be unimportant is at the South Pole. But that is not true. Byrd *had* to know the exact time to navigate properly. That's why 60 Hamiltons were selected as the official watches of the Byrd Antarctic Expedition—and four of them charted the Expedition plane across the icy wastes of the Pole itself.

Barring their winter trappings—special felt-lined extra cases—these Hamiltons are identically the same as the watches that time our country's fastest trains . . . and snuggle in the pockets of our most successful business chiefs.

Whether it is at the South Pole, the North Pole, with the country's air-mail pilots, in *your* pocket or on *your* wrist, every Hamilton is an accurate timepiece you would be proud to own.

Let us send you "The Timekeeper," an unusual little booklet, beautifully illustrated, showing a complete assortment of beautiful new Hamilton models. Address Hamilton Watch Company, American manufacturers of high-grade watches, 901 Columbia Avenue, Lancaster, Penna., U. S. A.

Hamilton *The Watch of Railroad Accuracy*



Above—The "MASTERPIECE," Model C. The dial of sterling silver has raised numerals of solid gold and solid gold hands. In 18k white or green gold with 23 jewels, $250.

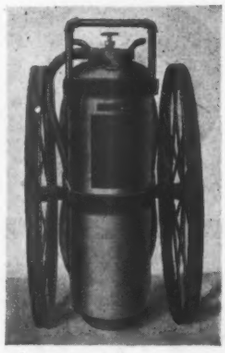
Below—The "FLOYD BENNETT." In 14k yellow or white gold, with 19 jewels, $150.

Other pocket, strap and wrist models for men and women from $48 to $685.

Complete Fire Protection in below-zero weather!

An absolute necessity for Hangars, Airports, and Airplane Factories

BADGER offers Fire Protection for every need



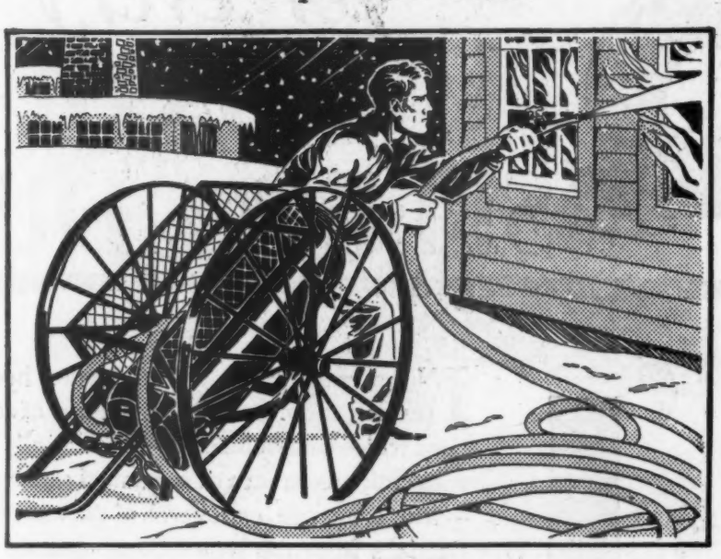
Picture shows 40 gal. non-freeze chemical engine, indoor type with narrow tread. Made also with wide tread for use outdoors. We also build foam engines, particularly valuable for hangars and airplane factories, and soda-acid engines.

(Left) 2½ gal. hand extinguisher. Made in foam and soda-acid types, also in 1¼ gal. size. A positive, inexpensive protection against incipient fires.

(Right) 1 and 1½ quart carbon tetrachloride type hand extinguishers. Effective fire protection — especially recommended for use on electrical apparatus as liquid is non-conductor of electricity. Harmless to fabrics and wood.

• • •

All Badger Extinguishers are approved and recommended for use by the Underwriters Laboratories, and the Factory Mutuals.



BADGER'S Non-Freeze 40 Gal. Fire Engine

BADGER'S Non-Freeze Fire Engine banishes the fearful extra hazard of winter fires. It has passed every test of the Underwriters Laboratories and Factory Mutuals, and is recommended by them for use. It's always on the job, in hottest summer weather, or when the mercury is 40° below zero or lower. You don't have to empty it or keep it in a warm place in winter, as with ordinary extinguishers. Leave it in an unheated hangar or shed—even on the flying field, if you like. There's nothing to freeze or clog. In the coldest weather you can have almost instantly a big volume of liquid under high pressure that will quickly put out any ordinary fire before it gets dangerous.

Every hangar, airport, and airplane factory should have at least one Badger Non-Freeze Engine. It may avert disaster where ordinary fire fighting equipment is useless because of cold.

Badger Non-Freeze Engines can be pushed to a fire and operated by one man. A single lever starts the stream. The yearly cost is practically nothing, as depreciation is negligible, and there are no parts to wear out. Recharging cost is nominal.

Badger offers the only approved 40 gallon non-freeze engine. It gives unique year-round fire protection that can not be duplicated elsewhere. Investigate today.

Delay means Danger! Send for details and prices of Non-Freeze Engine—NOW!

BADGER FIRE EXTINGUISHER CO.

962 Park Square Building, Boston, Mass.

There is a PRECISION BEARING *for every* LOAD, SPEED *and* DUTY

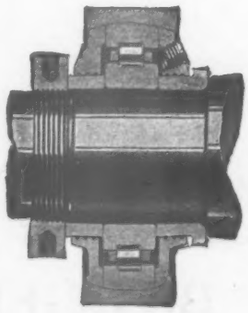
IN the entire range of anti-friction bearing service, there is not a combination of conditions which cannot be met—economically, and with entire assurance of continued satisfaction—with some one, or several, of the PRECISION Bearings from the NORMA-HOFFMANN line.

There need be no compromise, no half-solutions of the problem, NORMA-HOFFMANN engineers are never compelled to recommend a bearing that is "good-enough". In the comprehensive and diversified NORMA-HOFFMANN range of types and sizes, there is always a bearing that is the "right bearing" for the purpose.

Think what this means, where a single problem may require several bearing applications differing in conditions and duty.

PRECISION, a *standard* which is rarely approached but never excelled, outside the NORMA-HOFFMANN factories—*standard* bearings specially applied—one undivided responsibility covering every bearing application—where else can you get the all-comprehensive value which is here represented?

Write for Catalogs 904, 917 and 921, giving complete engineering data on the NORMA-HOFFMANN *Bearing line.*



"NORMA-HOFFMANN"

PRECISION BEARINGS

N-1011

NORMA-HOFFMANN BEARINGS CORPN.—STAMFORD CONN. U.S.A.

Everything You've Wanted In a Plane

Kari-Keen AIRCRAFT, INC.
Coupe

"The Baby Grand of the Air"

Private owners, commercial operators and flying schools will find in the Kari-Keen Coupe, every desirable feature they have been looking forward to for years. It is the most up-to-the-minute ship today, built on sound engineering principles, to meet the demands of modern flying and training problems.

Excellent visibility lends immediate confidence to student flyers and attracts veteran pilots. Unbelievable stability and quick-responding control make old-timers smile with satisfaction. Ample cabin space gives two persons real comfort side by side. Grace, attractive finish and general appointments catch the eye of everyone as soon as the ship sails into view.

See the Kari-Keen Coupe at the St. Louis Show—or let us tell you when there will be one at your airport. Distributor and dealer franchises are still available in some territories. Write for complete information.

Performance Facts

With 1000 Pound Load

Maximum Speed	105 M.P.H.
Cruising Speed	85 M.P.H.
Landing Speed	35 M.P.H.
Service Ceiling	16,000 Feet
Absolute Ceiling	18,000 Feet
Gasoline Consumption	4 gal. per Hour

With Full Load (1400 Pounds)

Maximum Speed	100 M.P.H.
Cruising Speed	80 M.P.H.
Landing Speed	40 M.P.H.
Service Ceiling	10,000 Feet
Absolute Ceiling	13,000 Feet
Gasoline Consumption,	4½ Gal. per Hour

Regular Equipment

Gasoline Capacity	18 Gal.
Oil Capacity	2½ Gal.
Power Plant	Velie

Oildraulic Shock Struts
Type "A" Consolidated Instrument Panel
Wired for Navigation Lights

KARI-KEEN AIRCRAFT, INC.
513 Plymouth Street **Sioux City, Iowa**

an announcement by
AMERICAN EAGLE

The flying public looks to American Eagle for progress. American Eagle is regarded in the aeronautical industry as an outstanding example in keeping a step ahead of the parade.

American Eagle aircraft, noteworthy criteria of stability, airworthiness, flyability and ruggedness, day after day, month after month and year after year, have set the pace.

To keep this faith always has been American Eagle's ambition. It always has been the goal of E. E. Porterfield, Jr., American Eagle's president. Each new American Eagle must be better than its predecessor; continually there must be new American Eagles—planes to fill every need of the flying public.

For 1930 American Eagle again strides forward with "something new". Every whim of engineer, production manager, pilot and salesman has been built into the new American Eagles.

Come to St. Louis February 15 to 23, inclusive and let us show you these new American Eagles. They'll be the highlights of the

INTERNATIONAL AIRCRAFT EXPOSITION

AERO BUILDING, ST. LOUIS, MO.

American Eagle presents the most complete line of aircraft—more models and more Approved Type Certificates, than any other independent factory in America! Dealers here is a real ooportunity!

AMERICAN EAGLE

"MASTER OF THE SKIES"

AIRCRAFT CORPORATION

FAIRFAX AIRPORT KANSAS CITY, KANS.

Brunner Equipped Machine Shop, Curtiss Flying Service Hangar, Buffalo, N. Y.

BRUNNER EQUIPMENT KEEPS THEM IN CONDITION

Compressed air plays an important part in the construction and servicing of aircraft. It saves time and insures better results on such important jobs as engine cleaning, operating pneumatic drills and hammers, tire inflation, greasing, dusting, blowing carbon, testing valves, cleaning ships, parts, etc. For the application of lacquer, special aircraft finishes and wing dope, it provides by far the most efficient method.

Brunner Equipment is built to furnish the dependable service which the aircraft industry demands. Models 854 and 868 are recommended for general hangar service. Special spray painting outfits complete with all necessary accessories are also available. Brunner engineers will cooperate in working out your equipment problems. Catalog No. 25 lists the complete Brunner line including spray guns, engine cleaners, blow guns, etc.

Brunner Equipment is sold by aeronautical and automotive jobbers. It is backed by the oldest and largest manufacturer of automotive air compressors in the world.

ENGINE CLEANING
with Brunner No. 78 Gun

SPRAY PAINTING
with Brunner Model 300 Gun

TESTING VALVES
with Brunner No. 35 Blow Gun

TIRE INFLATION
with dependable Brunner Air

MODEL 854
Completely Assembled Automatic Outfit. 2 H. P. motor, 8.7 cu. ft. displacement

AIRCRAFT DIVISION
BRUNNER MFG. CO.
UTICA, N. Y.

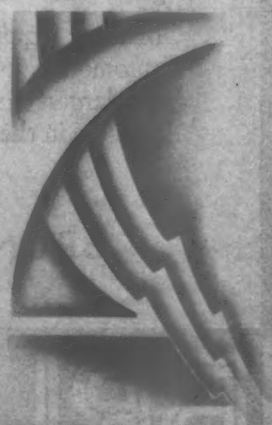
BRUNNER — AIR — COMPRESSORS
A WORLD'S STANDARD OF DEPENDABILITY

A FUTURE

"Capitol of Aeronautics"

IN THE MAKING

EVERY BRANCH of aeronautics is provided for in the plans for the new Glenn L. Martin airport and plant now taking form at Middle River, on the outskirts of Baltimore. There will be laboratories for the engineer, shops for the artisan, a school for the student with courses covering both design and flying, a residence colony with hydroplane landing for the amateur, and a hotel, restaurant and camp for interested visitors.



The* GLENN L. MARTIN *Co.

Builders of Quality Aircraft since 1909

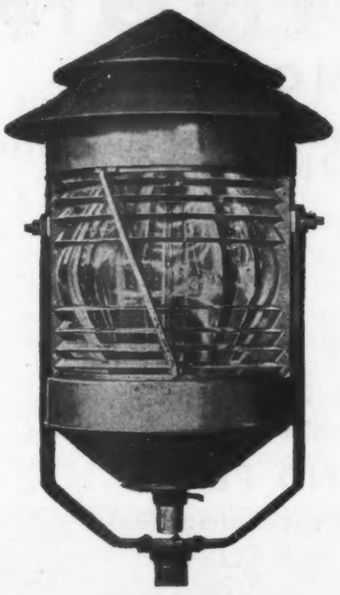
BALTIMORE, MARYLAND

Announcing

A *New* Landing Floodlight

by B. B. T.

Low in Price



Type L-8-D

High in Performance

FEATURES—375 M/M 9 Element 180° Fresnel Lens—Weatherproof Housing—16″ 180° Chromium Reflector—Trunion Mounting—3 K. W. 32 Volt Lamp.

Designed Specifically for Series Installation
at those "Hard to Light" Airports of Uneven Contours and Irregular shaped Landing Areas.

Airports where Runway Lighting only is desired.

Airports of the Smaller Size.

Airports who desire but a portion of their Landing Area illuminated at first—the balance to be added later.

AIRPORT ENGINEERS and others who prefer the Multiple or Distributed system of Floodlighting will be surprised to learn how much more effectively and economically this latest *Type L-8-D* will meet and surpass their every requirement in this connection.

Nothing has been sacrificed to bring this unit within the purchasing power of even the Smallest Airport or Air School—it is equal in Quality to the other members of "Aviations Bad Weather Floodlights" the internationally known *M-8-D Air Mail Unit—H-8-E 10 K.W.* and *H-8-D 5 K.W.* incandescent floodlights.

DON'T FAIL TO SEE IT AT THE ST. LOUIS SHOW—BOOTH 85—BUILDING B

Write for full particulars, price, etc., to

B·B·T
CORPORATION OF AMERICA
ATLANTIC BUILDING
PHILADELPHIA

FOR SAFETY'S SAKE—FLOODLIGHT WITH B.B.T.

COMMAND-AIRE ANNOUNCES

» » for 1930 « «

3-PLACE OPEN SPORT

POWERED BY

LYCOMING

210 H. P. MOTOR

$5675

Features: Wheel brakes, Hydraulic landing gear—outrigger type, Steel propeller, Tail wheel, Finest instruments.

\+ + +

3-PLACE OPEN SPORT

POWERED WITH CURTISS CHALLENGER
170 H. P. MOTOR

SEA PLANE (Edo Pontoons) A. T. C. 184-S

LAND PLANE (Hydraulic Landing Gear) A. T. C. 184

Features: ECLIPSE STARTER, Wheel brakes on land plane, Steel propeller, Complete Instruments finest type.

$6950
For the Sea Plane

$6000
For the Land Plane

\+ + +

3-PLACE SPORT TRAINER

WITH 110 H. P. WARNER MOTOR
Approved Type CTF. No. 151

Features: Especially designed cockpit; equipped with finest instruments; Hydraulic landing gear or GOODYEAR AIR WHEEL EQUIPMENT.

$4800
All Prices List
Fly Away Little Rock

Prices, Performance and Equipment, Together with Dealer Discounts are Calculated to Attract and Interest the Most Discriminating Dealer.

SEE THESE PLANES AT THE SAINT LOUIS SHOW

COMMAND-AIRE, Inc., Little Rock, Arkansas

COMMAND-AIRE

Brilliant lights that pick the SPOT

EXIDE AIRCRAFT Battery is specially designed for hard flying service

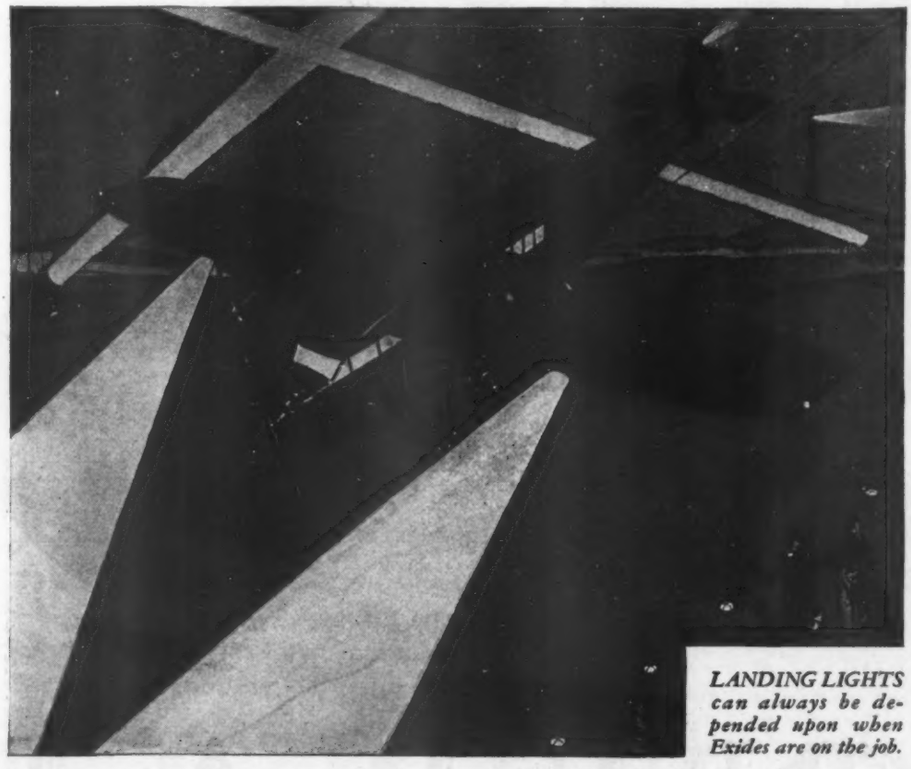
Steady, reliable lighting assured by Exide Aircraft Batteries

TWO shafts of brilliant light knife the darkness. Ground crews rush forward to meet the incoming transport as she settles safely to earth. And once more Exide Aircraft Batteries prove a dependable power source for landing lights.

Not only do these batteries assure utmost landing light efficiency, but also supply steady, reliable current for radio power . . . instrument and navigation lights . . . starting and ignition. And airmen throughout the world know that millions of miles of gruelling air service stand witness to the dependable, trouble-free performance of Exide Aircraft Batteries. That's why they choose Exides as equipment for any type of plane in any type of service.

Exide Aircraft Batteries are backed by the 42 years' experience of the world's largest battery specialists. Light in weight and strong in construction, they are designed so that the *electrolyte will not spill.* And every Exide is economical . . . absolutely dependable.

Write NOW, for full information. We will send you interesting data on the many types of Exide Aircraft Batteries and their varied applications. No obligation.



LANDING LIGHTS can always be depended upon when Exides are on the job.

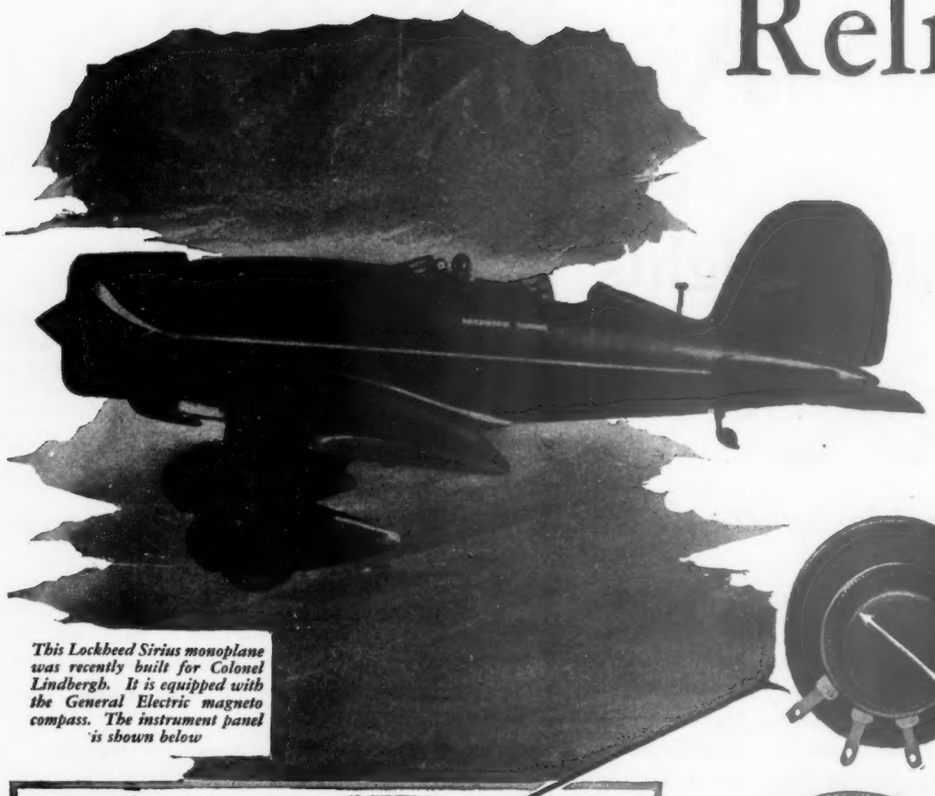
Exide
AIRCRAFT BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto

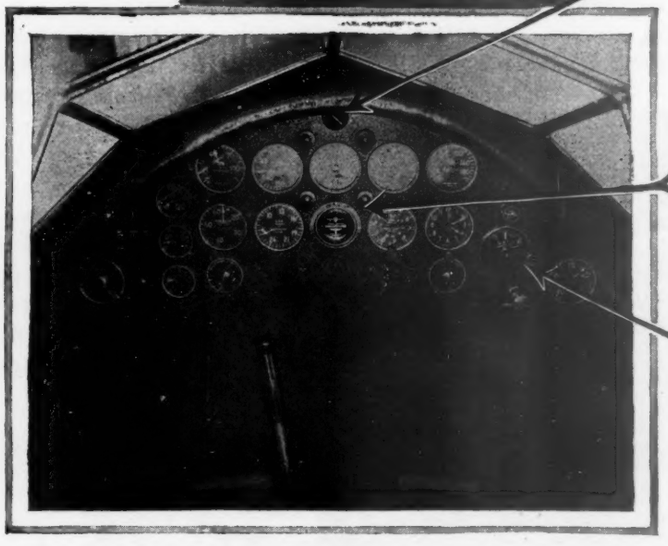
Reliability



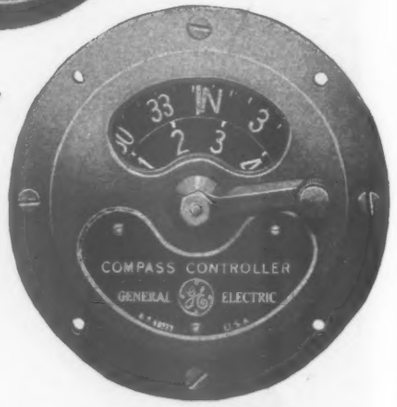
This Lockheed Sirius monoplane was recently built for Colonel Lindbergh. It is equipped with the General Electric magneto compass. The instrument panel is shown below

The generating unit is the heart of the magneto compass

A controller provides sensitivity adjustment to suit the needs of the pilot in flight



The compass indicator is built to withstand severe vibration



The course-setting controller gives the pilot complete directional control

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 9 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL

and Light Weight Distinguish GENERAL ELECTRIC EQUIPMENT

THE MAGNETO COMPASS combines reliability and light weight to a degree never before attained in an aircraft instrument of this character. For example, in the generating unit there are no universal joints; a damped pendulum system maintains proper relation with the earth's magnetic field and provides exceptional stability. Furthermore, directional indications depend upon the position of pole pieces—not the position of the brushes. The weight of the generating unit complete with wind-driven impeller is 5.6 lb. The accessories add about 6 lb.

THE CARD COMPASS admirably serves the need for an accurate instrument of moderate cost. A special vibration-absorbing bracket permits base, ceiling, wall, or panel mounting. Other features include: non-glare lighting; ground-glass lens; luminous dial and lubber line; and adjustable compensation. The weight complete is 1.9 lb.

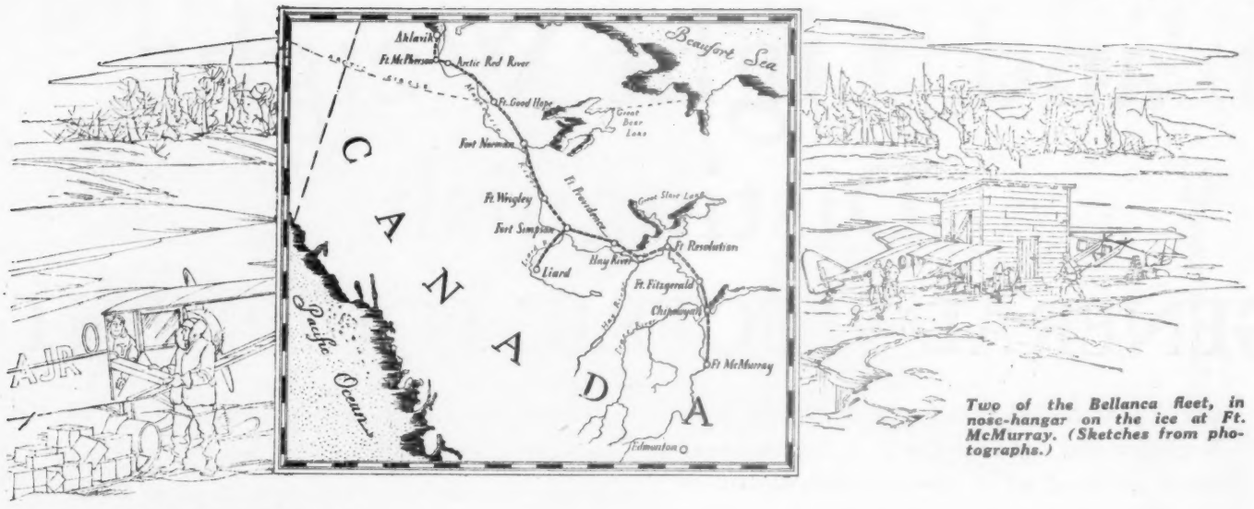
THE ENGINE-TEMPERATURE INDICATOR enables the pilot to read engine temperature direct—regardless of the temperature of the oil supply or cooling liquid. It is accurate and reliable; it requires no battery; it is not connected with the ignition system. The weight complete is 1.2 lb.

THE OIL IMMERSION HEATER should be a part of the equipment of every hangar. It is suitable for connection to any standard electric-lighting circuit. Placed in the oil tank of an engine, it heats the oil properly and facilitates a safe, quick start.

RECENT General Electric developments also include built-in, wing-type landing lights and radio-shielding ignition harnesses. For complete information, address the General Electric Company, Schenectady, N. Y.—manufacturer of lighting equipment, instruments for navigation and flight, engine accessories, and sundry devices for the aëronautic industry.

700-2

ELECTRIC



Two of the Bellanca fleet, in nose-hangar on the ice at Ft. McMurray. (Sketches from photographs.)

Loading a Bellanca Pacemaker at Ft. McMurray with express for the Arctic.

BELLANCA Performance in the Frozen North Again Confirms Bellanca Efficiency

Telegram received by Bellanca Aircraft of Canada, Ltd.—"Congratulate you on wonderful combination of Bellanca Pacemaker and Canadian Wright J-6 engine, both of which functioned perfectly and without complaint over whole mail run from Ft. McMurray to Aklavik and return despite very severe weather conditions. W. R. Wop May, Commercial Airways, Ltd."

This airline through the Arctic wilderness has opened a new swift contact with isolated settlements—a step of progress highly significant to Canadian commerce. Passengers, mail and express are flown regularly over the 1,800-mile route with speed and safety, . . bridging great tracts of almost impassable, heavily-wooded and mountainous country. The Commercial Airways run is one of the most arduous in the world.

Needless to add, the fleet of Bellanca Pacemakers was selected by these veteran operators after the most careful analysis of efficiency and operating economy, followed by tests of several competitive types of aircraft. Such facts as these speak for themselves!

Complete specifications and performance data of the Bellanca Pacemaker on request.

Bellanca Aircraft Corporation
New Castle, Delaware

Bellanca Agents at the following points will be pleased to serve you in every possible way.

Baltimore Airways, Inc., 32 So. Calvert St., Baltimore, Md. or Handler Field, Baltimore, Md.

Garland Aircraft Corporation, 22nd Floor, Philtower Bldg., Tulsa, Okla.

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Hercules Aeroplane Products Company, 5301 Eleventh Ave., Los Angeles, Calif.

Inter-Island Airways, Ltd., Honolulu, Hawaii.

Mr. Eduardo Meade (Transportes Aereos Transcontinentales, S. A.), Capuchinas 53, Mexico, D. F., Mexico.

Ohio Air Transport, Inc., 802 First National Bank Bldg., Youngstown, Ohio.

Pal-Waukee Airport, Inc., 1116 Marquette Building, Chicago, Ill. or Des Plaines, Ill.

Pocahontas Air Transport Corporation, Bluefield, West, Va.

Simmons Aircraft Division, Steel, Inc., Chamber of Commerce Bldg., Los Angeles, Cal.

Skyways, Inc., Boston Airport, East Boston, Mass.

Thurmond Aircraft Corporation, 1019 R. A. Long Bldg., Kansas City, Mo.

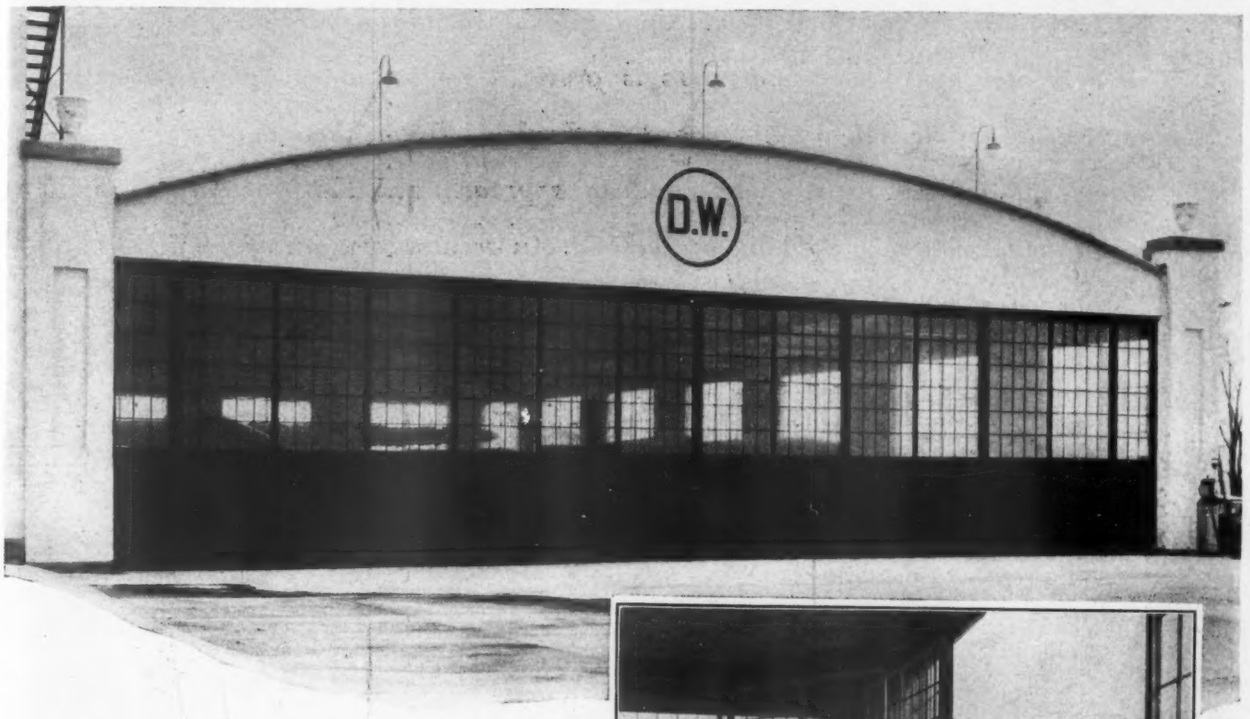
Wilkes-Barre Wyoming Valley Airport, Inc., Wilkes-Barre, Pa.

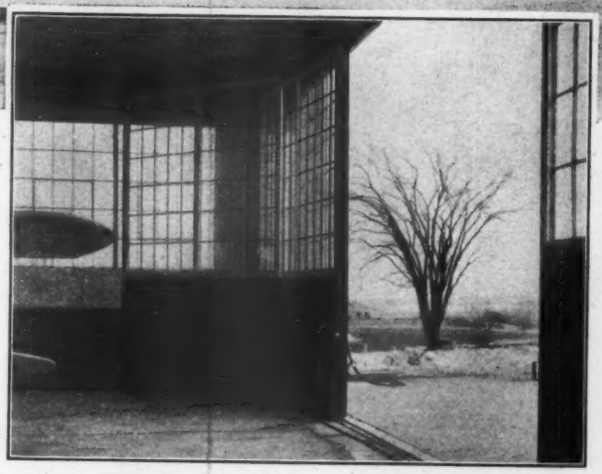
Canadian Distributors

Bellanca Aircraft of Canada, Ltd., 4221 St. Catherine St. West, Montreal, P. Q., Canada

BELLANCA

STANDARDIZED HANGARS





New D. W. Flying Service Hangar at LeRoy, N. Y., near Rochester, Steel Doors, Curved Track Type.

Truscon has specialized in housing for aeronautical requirements. Truscon Standardized Hangars—furnished in sizes and types for individual requirements—provide clear floor space, thorough fire protection and ample daylight. These permanent hangars can be readily enlarged or re-erected in a new location.

Truscon Steel Hangar Doors open the full width to permit the easy handling of airplanes. They operate easily and are sturdily built to give enduring service. They are furnished in all sizes and may have large glass areas for daylighting. Two types—Straight or Curved Track—are available to meet any hangar requirements.

Write for suggestions, quotations and literature.

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO
Warehouses and Offices in Principal Cities
Truscon Steel Company of Canada, Limited, Walkerville, Ontario

A PRODUCT OF TRUSCON

STEEL HANGAR DOORS

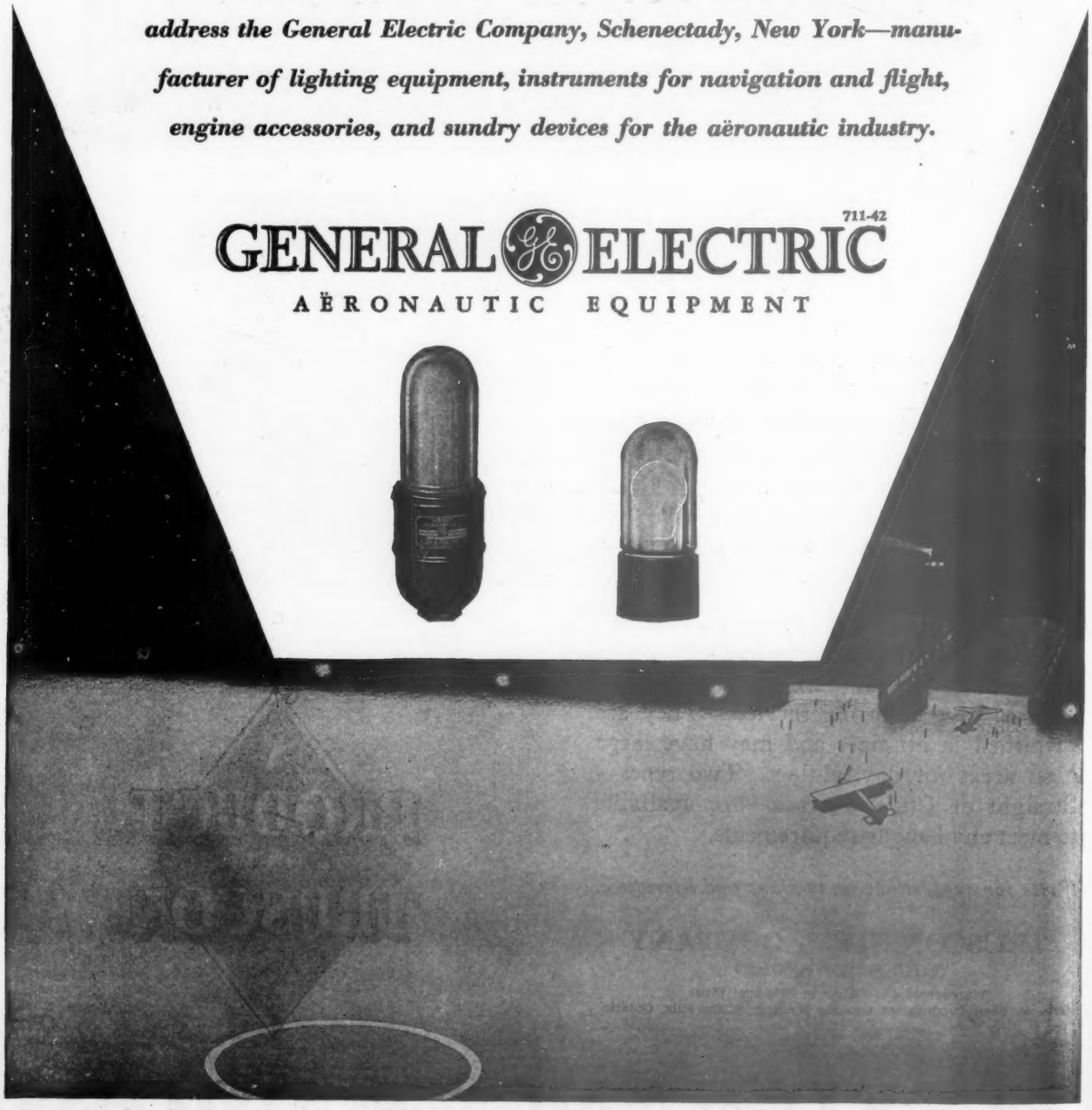
BOUNDARY LIGHTS

AFTER dark, the pilot first locates the airport by means of its rotating beacon. His next and more exact indication is provided by boundary lights spaced at intervals of not more than 300 feet around the field. Most of these lights are white. Green lights indicate favorable angles of approach; red, the proximity of an obstruction such as a pole line or building. An accurate pattern of the field is thus before him. G-E boundary lights are now in service at more than 60 per cent of the lighted airports in the United States. For complete information, address the General Electric Company, Schenectady, New York—manufacturer of lighting equipment, instruments for navigation and flight, engine accessories, and sundry devices for the aëronautic industry.

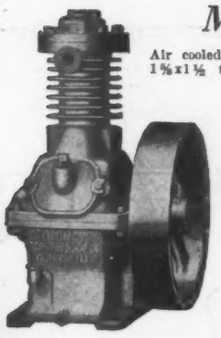
711-42

GENERAL ELECTRIC

AËRONAUTIC EQUIPMENT



LIGHT WILL PUT YOUR AIRPORT ON THE NIGHT MAP OF AMERICA



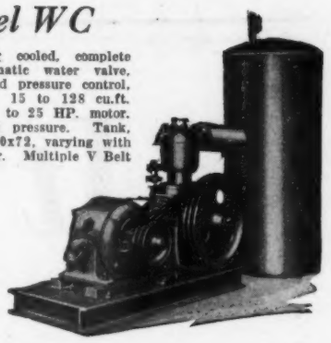
Model A

Air cooled and made in sizes from 1⅝x1½ to 4½x5. Displacements from 1 cu.ft. to 27 cu.ft., depending upon size of compressor, and motor used.

Furnished also with tight and loose pulleys, if desired, or with V type pulley.

Model WC

Automatic, water cooled, complete unit with automatic water valve, motor started and pressure control, for heavy duty. 15 to 128 cu.ft. displacements; 2 to 25 HP. motor. 150 lb. cut off pressure. Tank, 18x72, 24x72, 30x72, varying with size of compressor. Multiple V Belt drive.



Quincy

To Airport Operators and Airplane Manufacturers who are "up" on compressors, "Quincy" stands for "Quality"—a high standard of quality that begins at the very foundation—the design.

Quincy design is of such a character that Quincy operation is noticeably quiet—so quiet that you realize at once that here is perfection.

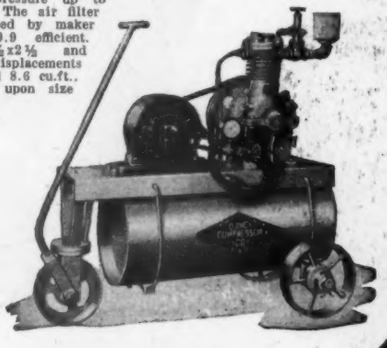
And that realization is confirmed and re-confirmed throughout the whole long life of the compressor; for high efficiency and low maintenance cost extend far beyond your fondest expectations. That is why the Quincy warrant of absolute satisfaction is unlimited.

For paint and dope spraying, operating pneumatic tools and lifts, for spray cleaning engines, blowing out gas and oil lines, inflating tires—get a Quincy for real economy.

Write for complete information, or send the coupon at right.

Model PX
Paint Spraying Unit

A compact, portable three-wheel unit. Complete, ready to operate paint spray equipment. Has 20-gal. tank, pressure gauge, safety valve and drain cock; also suction unloader to maintain operating pressure of 80 lbs., which may be adjusted for any suitable pressure up to 100 lbs. The air filter is warranted by maker to be 99.9 efficient. Sizes 2½x2½ and 3x3½. Displacements 4.2, 6 and 8.6 cu.ft., depending upon size of motor.



QUINCY COMPRESSOR CO.,
208 Maine St., Quincy, Ill.

Please send complete information about Quincy Compressors for use as follows:

.....

.....

.....

Firm Name.....

Address.....

City.....State.....

QUINCY COMPRESSOR CO.

208 Maine St., QUINCY ILLINOIS QUINCY C.O. COMPRESSOR Quincy, Ill.

SERVICE AND SALES OFFICES

Atlanta, Ga.
Birmingham, Ala.
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Also in Other Important Centers
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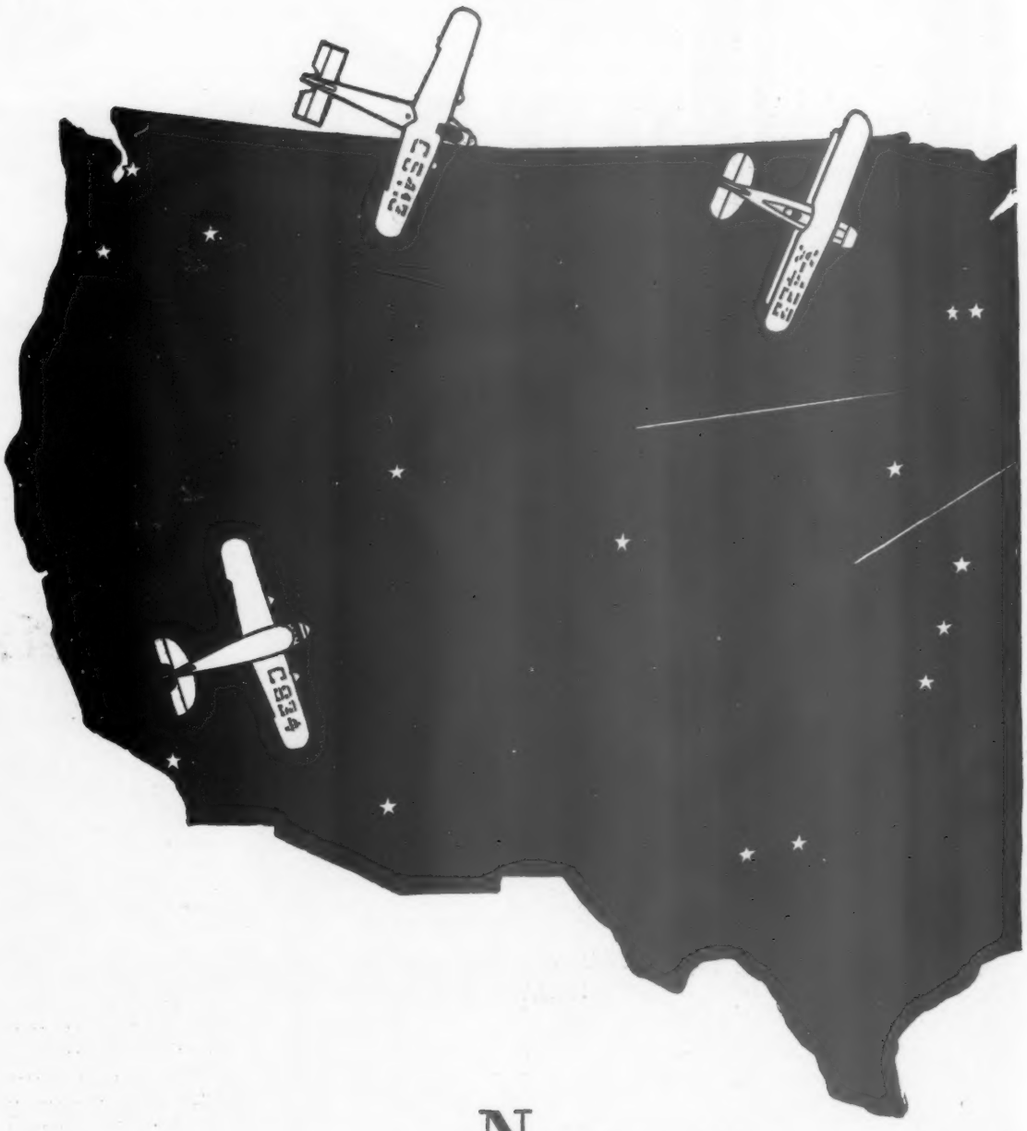
N1050

It's Pontiac . . .



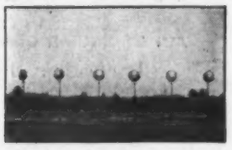
NIGHT after night, the municipal airport at Pontiac stands out on the map—a splash of light against the darkness. It's no task for the night-flier to locate this well-lighted airport. Graybar Airport Lighting has made this field as easy to find . . . as easy to identify . . . as easy and safe to land upon by night as by day.

You'll find many another Graybar lighted airport from coast to coast. Such wide ex-

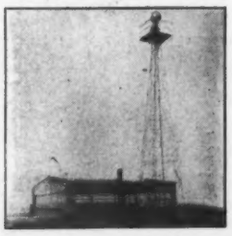
★—*Small white stars indicate Graybar-lighted airports in all parts of the country.*

TUNE IN ON THE GRAYBAR HOUR, 10 TO 10:30 EASTERN STANDARD TIME, EVERY TUESDAY NIGHT . . . . COLUMBIA BROADCASTING SYSTEM

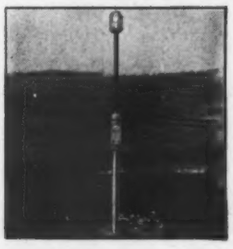
Pontiac Hangar



Field floodlights



Revolving beacon



Boundary light

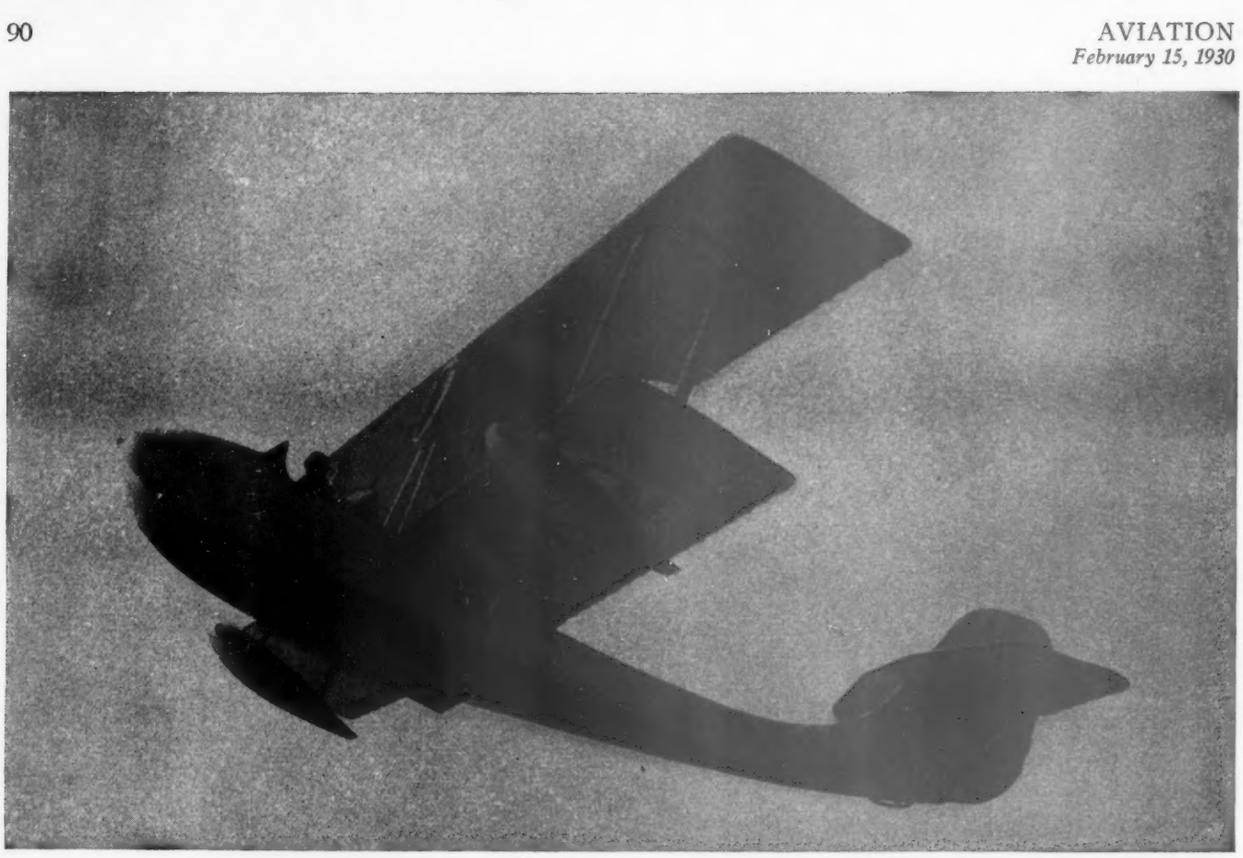
perience has made Graybar especially qualified to answer airport lighting questions. How for instance, must one meet the requirements of the Department of Commerce? What is the best type of beacon? What about candle-power?

For the solution of these and many other lighting problems, Graybar's Airport Lighting Department stands always ready to offer the benefits of its experience to those interested.

GraybaR

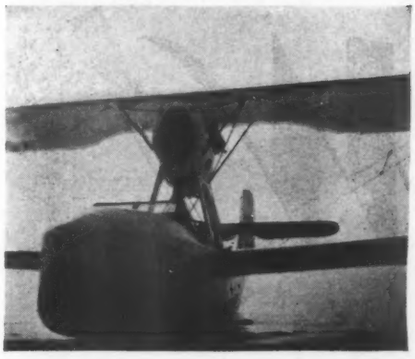
AIRPORT LIGHTING

OFFICES IN 73 PRINCIPAL CITIES . . . . . EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.



An amphibian or flying boat of unusual design and performance. For further information and specifications of the Viking read the page opposite.

A three place plane combining safety and performance—but read the details about the Kittyhawk on the page to the left.



The Viking Amphibian and Flying Boat is the American interpretation of the Schreck F. B. A. . . . a plane that has a record of 6,000,000 miles without a structural accident . . . it is standard equipment in the French Navy—where it receives strenuous use in training pilots and with the fleet at sea.

Built in America by American capital, by American workmen and powered with an American engine . . . the Viking is unusual in design . . . the pusher type propeller forces the airstream directly onto the rudder and elevators giving more positive action on the controls . . . the Viking has a stability, maneuverability and performance which no flying boat in the same price range can equal.

Specifications of the Viking Amphibian and Flying Boat:

High Speed	102 M. P. H.	Duration	4¼ hours
Cruising	80 M. P. H.	Length	29 ft. 4 in.
Landing	40 M. P. H.	Height (on wheels)	11 ft. 3 in.
Climb (at Sea level)	600 ft. per min.	Span	42 ft. 3 in.
Service Ceiling	14,000 ft.	Wing Area	448 sq. ft.
Fuel Capacity	50 gals.	Capacity	4 persons
Range	320 miles	Engine—Wright J-6, R760	225 H. P.

Write to the Viking Flying Boat Company
89 Shelton Ave., New Haven, Conn. or
Causeway Island, Miami

THE VIKING FLYING BOAT

Experienced pilots have tried to spin the Kittyhawk . . . most have failed . . . others have succeeded, but even they have been unable to hold it there for more than three or four turns . . . few planes can duplicate that performance.

With a landing speed of 38 miles per hour . . . a wheel tread of 7 ft. 2 in. . . . the Kittyhawk is particularly adept at getting in and out of small, rough fields.

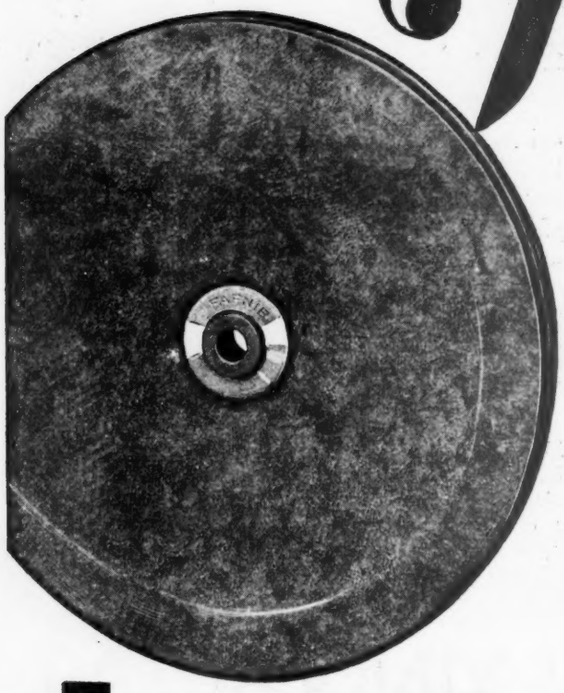
Its high factor of safety . . . its performance . . . and low maintenance cost make the Kittyhawk an unusual plane for training and commercial use . . . and a plane that even the most critical and experienced pilots will be glad to fly.

Specifications of the Kittyhawk Model B-4:

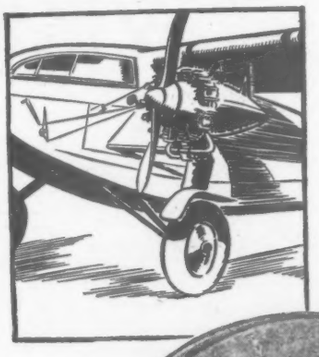
Engine—Kinner K-5	100 h. p.	Weight empty	1107 lbs.
Approved Type Certificate No. 166		Useful load	768 lbs.
Length overall	22 ft. 11 in.	High speed	110 m. p. h.
Height overall	8 ft. 8 in.	Cruising speed	90 m. p. h.
Span both wings	28 ft.	Landing speed	38 m. p. h.
Chord both wings	4 ft. 6 in.	Climb	1200 ft. p. m.
Wing area	233.4 sq. ft.		

Write to the Viking Flying Boat Company
89 Shelton Ave., New Haven, Conn. or
Causeway Island, Miami

THE KITTYHAWK



New! BALL BEARING *Aileron* PULLEYS

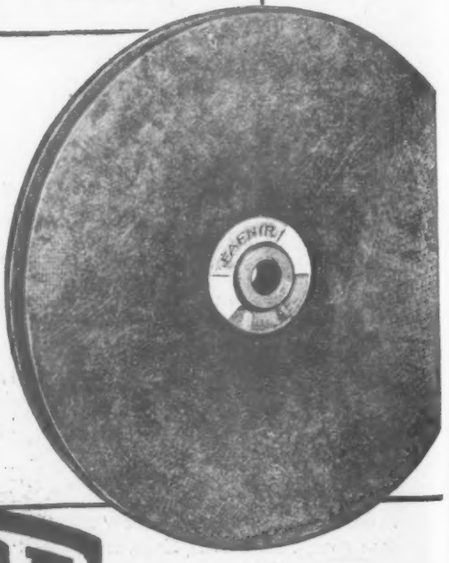


FORMICA has developed a line of ball bearing aileron pulleys with Fafnir ball bearings which relieve friction, keep in line without wabbling and operate without lubrication difficulties at extreme ranges of temperature.

These bearings will retain lubricant at a temperature of 120 degrees fahrenheit and the same lubricant will operate efficiently at a temperature of minus 20.

The body of the pulley is the canvas base Bakelite type. Another line of pulleys with bronze bushings is also offered by Formica.

Ask for quotations



THE FORMICA INSULATION CO.
4653 Spring Grove Ave. Cincinnati, Ohio

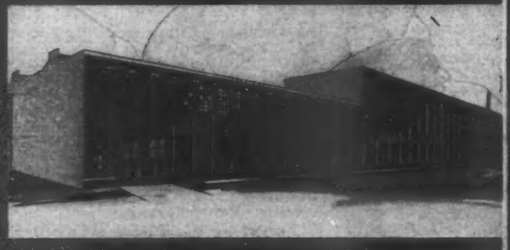
FORMICA

MOTO METER

GAUGE & EQUIPMENT CORPORATION

THE name MOTO METER is a guarantee of the excellence of any instrument or gauge on which it is placed. The three great plants of this company, now one of the world's largest manufacturers of gauges and allied equipment, are devoted to the manufacture of products of the highest quality.

Plant at La Crosse, Wis., devoted to the manufacture of instrument panels and panel equipment



MOTO METER GAUGE & EQUIPMENT CORPORATION

Toledo, O. LONG ISLAND CITY, N.Y. La Crosse, Wis.

FACTORIES AT LONG ISLAND CITY TOLEDO LA CROSSE
CANADA ENGLAND FRANCE GERMANY AUSTRALIA

MOTOMETER

ICE WARNING INDICATORS

The Moto Meter Ice Warning Indicator informs the pilot of the atmospheric conditions through which he is flying and enables him to avoid temperatures under which ice might form.

Two atmospheric conditions control ice formation—high humidity and low temperature. High humidity is easily seen as rain, fog, mist, etc. The Moto Meter Ice Warning Indicator keeps the pilot constantly informed of air temperatures.

This instrument is now being used by many of the leading Transport companies.

The Essential

STARTING - TAKING OFF -

Eclipse Aviation Engine Starters and Generators

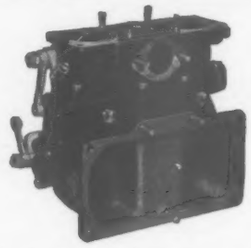
Eclipse Aircraft Engine Starters and Generators are made for every aircraft requirement. They are precision built, are light in weight and constructed of specially selected materials.

Several types of starters are available—inertia, direct cranking, etc.—for electric and manual operation. The generators are built in various sizes and supply current for charging batteries, lighting, and radio.

Eclipse equipment is used on planes in the U. S. Naval and Military services, also on almost all planes engaged in Air Transport and other commercial operations.

For information on any specific installation, write to our engineering department.

Eclipse Aviation Corp., East Orange, N. J.
(Division of Bendix Aviation Corporation)



Stromberg Carburetors for Aircraft

Practically every record flight has been made with Stromberg Carburetors. They were used by Lindbergh in his flight to Paris, by Byrd in flying over the North and South Poles, by the endurance plane, St. Louis Robin, and by many other famous flyers, such as Chamberlain, Wilkins, and Hawks.

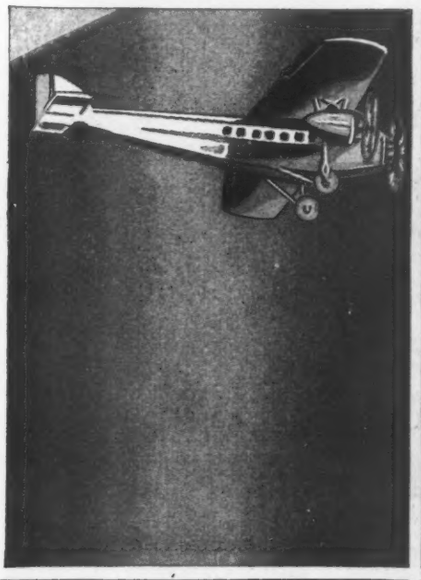
Still more significant, however, is the fact that in the daily task of carrying passengers and mail we find Stromberg Carburetors on 90 per cent of the planes in service—an unquestioned proof of Stromberg's leadership in this vital task of supplying scientific carburetion for airplane engines.

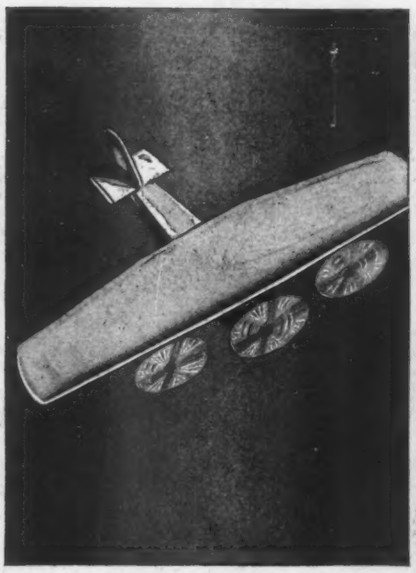
Stromberg Motor Devices Company
Chicago, Illinois
(Division of Bendix Aviation Corporation)

BENDIX

Units for - - - -

FLYING - NAVIGATING - LANDING -





Magneto and Battery Ignition

In flying—where sure ignition is vital—Scintilla Aircraft Magnetos predominate in aviation today. Delco Ignition also plays an important part. Constantly in commercial, private and military flying—these Bendix-made units are proving their reliability.

Scintilla Magneto Company
Sidney, N. Y.

Delco Aviation Corporation
Dayton, Ohio

(Divisions of Bendix Aviation Corporation)

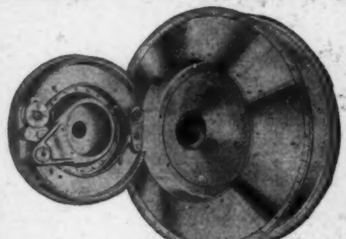
Pioneer Instruments

As the mariner trusts his compass, so, too, the airplane pilot depends on his Pioneer Instruments. From these he knows his location, direction, speed—everything necessary for safe flying. Pioneer Instruments were an important factor in winning the world's record for sustained flight—420 hours.

Pioneer Instruments have been used by famous flyers, such as Lindbergh, Chamberlain, Brock, Schlee, Wilkins, Byrd, and others. They include a wide variety of oil and fuel gauges, thermometers, altimeters, speed and drift indicators, air logs and air speed indicators, navigating lights, parachute flares, etc., as well as the vital climb, turn and bank indicators and the famous earth inductor compass.

Pioneer Instrument Company
Brooklyn, N. Y.

(Division of Bendix Aviation Corporation)



Bendix Airplane Wheels and Brakes

The great strength of Bendix Wheels and Brakes gives a pilot confidence in his ability to make a safe landing—even on a small, rough, emergency field. Their streamline design offers minimum resistance in the air.

Bendix Brakes eliminate the need of a ground crew, and make any plane easier and safer to handle.

For the maintenance of brakes at the point of maximum efficiency, there is nothing like the Cowdrey Brake Tester. Its readings show the exact stopping force at each wheel, permitting brake action to be most effective.

Bendix Brake Company, South Bend, Ind.
Bendix-Cowdrey Brake Tester, Inc.
Fitchburg, Mass.

(Divisions of Bendix Aviation Corporation)

PRODUCTS

Be sure you're right- then go ahead

A SOUTHERN city asked our opinion on a rather elaborate airport project under contemplation. Much to their astonishment, we recommended, after careful study, a drastic curtailment of their present program. Our survey had shown that the proposed initial expenditure could be materially reduced, and at the same time ample provision made for future expansion.

If your city is planning an airport, let A.D.C. specialists make an expert survey of local conditions and a preliminary layout of your requirements. Our recommendations will be unbiased and founded upon wide experience.

Every airport project is a special problem in itself. A.D.C. engineers, executives and pilots coordinate their knowledge to produce just the right job required in each particular case.

AIRPORT
DEVELOPMENT AND
CONSTRUCTION CO.
PHILADELPHIA

Consultants Engineers Builders

STROMBERG CARBURETORS

are used as standard equipment

. . . by . . .

The Alliance Aircraft Corp.
Allison Engineering Co.
American Cirrus Engine Co.
Axelson Machine Co.
Comet Engine Corp.
Continental Motors Corp.
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Fairchild Caminez Eng. Corp.
Kinner Airplane & Motor Corp.
Lambert Aircraft Co.
(formerly Velie Motors Corp.)
LeBlond Aircraft Engine Co.
Lycoming Motor
MacClatchie Manufacturing Co.
Michigan Aero Engine Corp.
Navy Department
Pratt & Whitney Aircraft
O. E. Szekely Corp.
War Dept.—Air Corps
Warner Aircraft Corps.
Wright Aero Corp.

STROMBERG

growing with aviation

Years ago when aviation was in the experimental stage Stromberg was experimenting, too, with an aircraft carburetor. One that would be dependable, light. That would supply the proper fuel mixture to the engine at all speeds, in all positions—efficiently and economically.

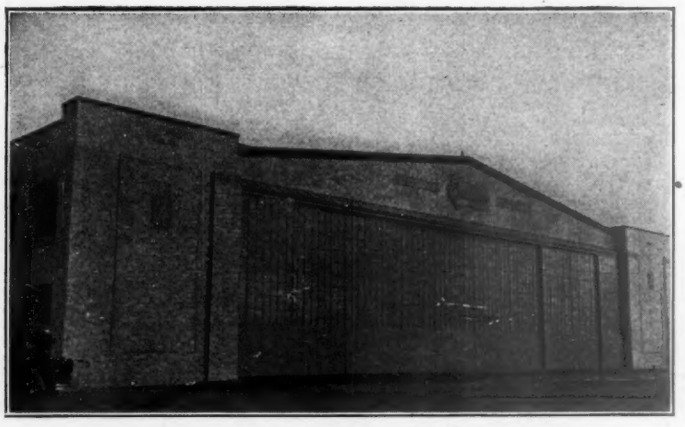
Such a carburetor was developed. The difficulties of propeller blast and upside down flying were overcome. A dependable, durable, economical carburetor was designed and built.

The aviation world quickly recognized the remarkably fine performance of Stromberg carburetors. With the result that over 90% of American aircraft flying today are Stromberg equipped. And—as aviation grows, and new planes and new engines are developed, inevitably builders turn to Stromberg for the solution of their carbureting problems.

STROMBERG MOTOR DEVICES COMPANY
58-68 E. Twenty-fifth Street, Chicago, Ill.
(Division of Bendix Aviation Corporation)
Factory Branches
New York, N. Y. Detroit, Mich. Minneapolis, Minn.
Kansas City, Mo. London, England

Line-up of planes at East Boston Airport

CURTISS-WRIGHT FLYING SERVICE AT BOSTON



Recently constructed hangar of the Curtiss-Wright Flying Service at East Boston Airport.

Curtiss-Wright Flying Service mechanic fuels a plane with Socony.

has always used Socony

THE Curtiss-Wright Flying Service at Boston has flown its planes from East Boston Airport with Socony Aviation products since its entry into the New England field.

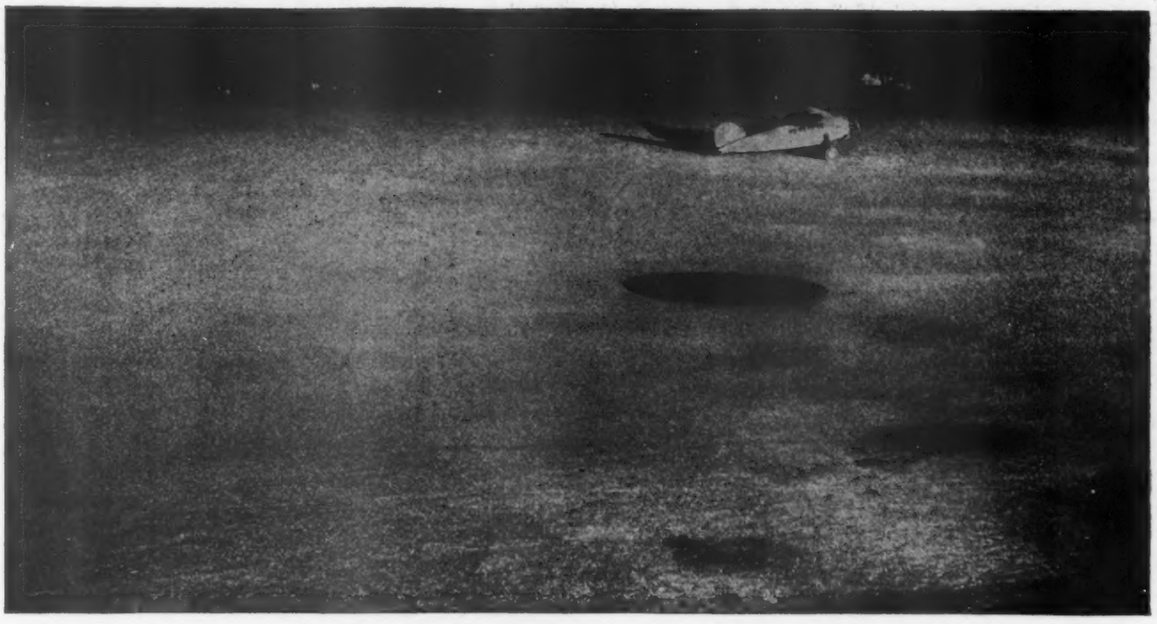
Operating 37 planes now, and increasing the number continually, this famous flying service has found Socony Aviation products highly satisfactory for its school of instruction and also for its air taxi service and scheduled passenger operations to Cape Cod and Nantucket.

Socony Aviation products are sold at nearly every large airport in New York and New England. Aviation pilots everywhere endorse these companion products.

SOCONY

Aviation Gasoline
Aircraft Oils

STANDARD OIL COMPANY OF NEW YORK



Airport Lighting...

designed by Pyle-National engineers *earns the approval of pilots and managers alike*

New Aircraft lighting equipment includes:

Landing Lights	*Avigation Lights*
—for standard mounting —built-in type —refractory type (built-in)	*Switches* for landing and avigation lights

See Pyle-National Lighting Equipment at Booths 213 and 214 in the Exhibition Building "A"

THEIR years of specialized experience in the design and application of large area lighting equipment assures economical installation and operation as well as completely satisfactory performance.

The complete line of Pyle-National lighting equipment including the new beacons, field floodlights and semi-submerged runway markers will be shown at St. Louis, February 15-23.

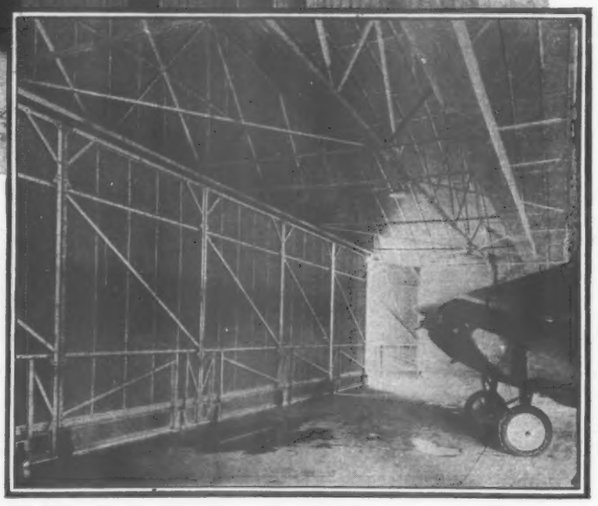
See this display and get full information on Pyle-National methods of lighting layout from Pyle-National engineers.

The Pyle-National Company

1334-1358 N. Kostner Avenue ~ Chicago, Ill., U. S. A.

A3-15-Gray

STOP FIGHTING COLD WEATHER



Interior and exterior views of IDECO Insulated Steel Hangar owned by Knapp Flying Service, Milo Oliphant, Mgr. Ypsilanti, Michigan.

Throw away your oil stoves and other motor heaters—Quit fighting frozen oil and cold motors—House your ships and personnel in warm, comfortable hangars.

IDECO Insulated Steel Hangars offer the same protection against cold as 13-in. brick or 20-in. concrete wall construction, yet cost considerably less and retain all of the economies and advantages of steel construction.

An analysis of the heating efficiency made in a comparison between an insulated and uninsulated hangar (60x120x12), located in Michigan, during the winter period revealed a fuel saving in the insulated hangar of 108 tons of coal. 108 tons at $5.00 per ton is $540.00.

ARMCO Ingot Iron

The insulation feature of IDECO Hangars is a distinctive asset—this is combined with permanence, sectional construction, full fire and rust protection, attractive appearance, full width, easy operating inside nesting doors and clear open spans from 40 to 120 ft.

IDECO Hangars offer you the advantages of immediate occupancy, decreased maintenance and insurance costs, complete protection against heat or cold and the release of working capital for other uses.

Write for further information.

The International Derrick & Equipment Company

Columbus, Ohio — **Houston, Texas** — **Los Angeles, Cal.**

New York · Wichita · Oklahoma City · Tulsa · Ft. Worth · Beaumont
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Export Office—74 Trinity Place, New York

750

IDECO STEEL HANGARS, AIRPORT & AIRWAY EQUIPMENT

WRIGHT FLIES THE DARTMOUTH PROFS!

FOR one whole day Wright's big tri-motor soared over Dartmouth's campus. Every one of its 2500 students, every professor, every college official—and the entire town of Hanover, took keen interest in the flights. For Wright made the trips to demonstrate the practical ease, comfort, speed, and economy of Aviation. Almost a hundred people went up. But the ones most vitally interested were the Dean and others connected with the Business School. For here they learned at first hand why and how Flying's part in business is growing by leaps and bounds!

WRIGHT

AERONAUTICAL CORPORATION
PATERSON, NEW JERSEY

FOR YOUR *APPROVAL*

at the St. Louis Show

THE S.S.P.

BABY ACE

"A BABY IN SIZE . . . AN ACE IN PERFORMANCE"

A single place cabin ship of proven performance

DESIGNED BY O. G. CORBEN

SEE ITS

GRACEFUL APPEARANCE
STURDY CONSTRUCTION
at the exhibit

REMARKABLE STABILITY
UNBELIEVABLE PERFORMANCE
at the field

NEW DEALER'S PLAN! Dealer territory still available will be allotted at the exposition. If you are unable to attend, write, or wire direct for complete details.

And the Price is Equally Amazing

FLYAWAY $1895.00

ACE AIRCRAFT MANUFACTURING CORPORATION
1026 South Santa Fe, WICHITA, KANSAS

WHERE UDYLITE
BEAUTIFIES AND PROTECTS

In The Air With UDYLITE

A mighty transport plane wallows through wet clouds; the mail pilot dives below icy sleet; a seaplane sprays salt water—deadly rust lurks in the air. That is why Udylite protection is so popular up there. It is the reason for the Udylite Process guarding one manufacturer's planes which have traveled over eight million miles in the last 28 months.

Precision Products Need this Protection

Whether the product is a swiftly moving plane, a modern automobile, a trim speed boat or precision machinery parts, Udylite is specified as the true protection against rust and corrosion. Submerged in fresh or salt water; subjected to factory steam, cloud moisture or the many other destructive factors, the Udylite Process provides permanent protection, lasting beauty and long, useful life to precision products.

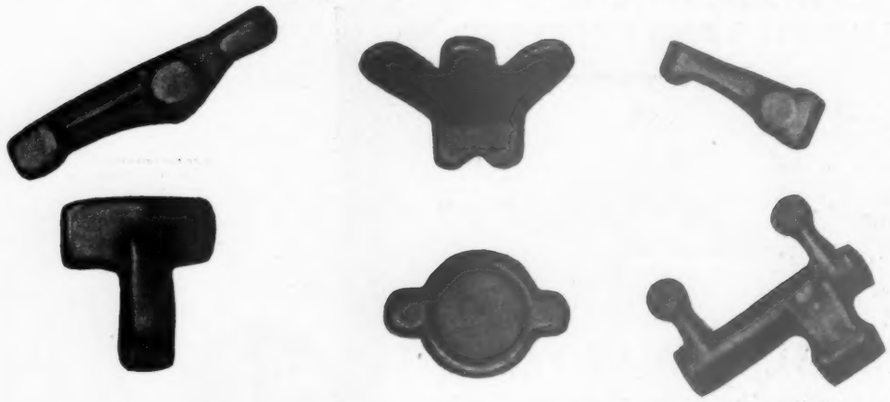
Udylite
RUST PROOFS

THE UDYLITE PROCESS COMPANY
3220 Bellevue Avenue
DETROIT, MICH.

Eastern Office:
30 East 42nd St., New York

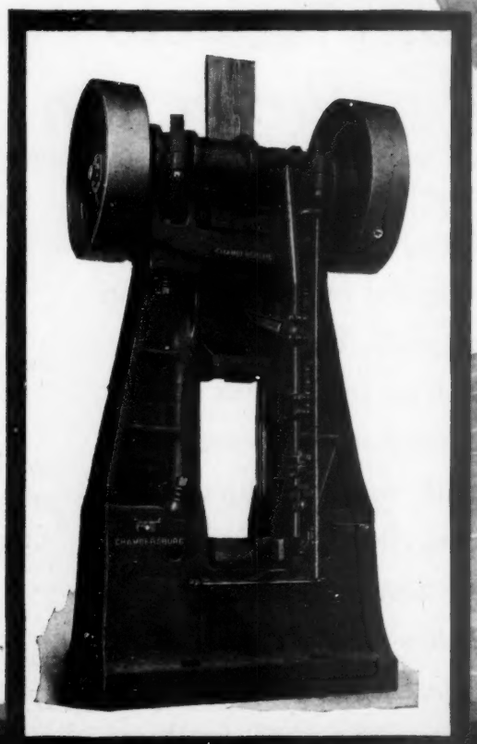
Western Sales Office:
114 Sansome St., San Francisco, Cal.

DROP FORGINGS FOR RELIABILITY



On Chambersburg Hammers

Every airplane part that must stand up under the constant grind of repeated service is a vital part. Vital parts such as these illustrated above naturally are drop forgings, and just as naturally were forged on Chambersburg Hammers.



Chambersburg Hammers have been used in the production of forged parts for many of the most important names in the automotive industry since its very beginning . . . And in aviation, the youngest branch of that industry, Chambersburg hammers are again associated with the most important names.

CHAMBERSBURG ENGINEERING COMPANY

CHAMBERSBURG . . . . . PENNA.

Sold by

CHAMBERSBURG-NATIONAL

COMPLETE FORGING EQUIPMENT

CHAMBERSBURG, PA. TIFFIN, OHIO

New York, 122 W. 42nd St. Chicago, 565 W. Washington St.

Detroit, 2457 Woodward Avenue

CHAMBERSBURG HAMMERS

Keystone Photo

New Lockheed low-winged monoplane, two-seater sport ship, built in Los Angeles especially for Colonel Charles A. Lindbergh and equipped with dual controls. Much of the specialized streamlined construction follows the suggestions of the flying colonel himself. The plane's builders believe it will develop 150 miles an hour at top speed. It has a cruising radius of nearly 3500 miles.

THERE is no substitute for dependability in aviation engines — every unit must bear its share of the loads and stresses with a margin of safety to spare.—Another reason why SRB Ball Bearings predominate in the aviation engine field!

SRB construction with its maximum number of largest possible balls, all of which are hot-forged from Molybdenum steel, gives that added factor of safety which is so essential.

Specify SRB Ball Bearings for longer life and increased efficiency.

STANDARD STEEL AND BEARINGS INCORPORATED
Plainville DIVISION OF MARLIN-ROCKWELL CORPORATION *Connecticut*

PACIFIC COAST DISTRIBUTORS
F. M. Cobbledick Co., *San Francisco, Cal.* E. D. Maltby Co., *Los Angeles, Cal.* Northwest Bearings Co., *Seattle, Wash.*

Ball SRB Bearings

3 pioneers pass another milestone of dependable service

The passing of 1929 marked the close of another year of dependable service by the air mail . . . that pioneer of commercial aviation.

Likewise, 1929 marked the completion of a year of dependable service by two other pioneers in the aviation industry . . . Stanolind Aviation Gasoline, Stanolind Aero Oil. Early in the history of commercial aviation these two products began to contribute their share to the success of flying. No more convincing proof of the dependability with which they perform can be found than in the record they have made . . . many thousands of flying hours with never an engine failure traceable to any fault in either of these products.

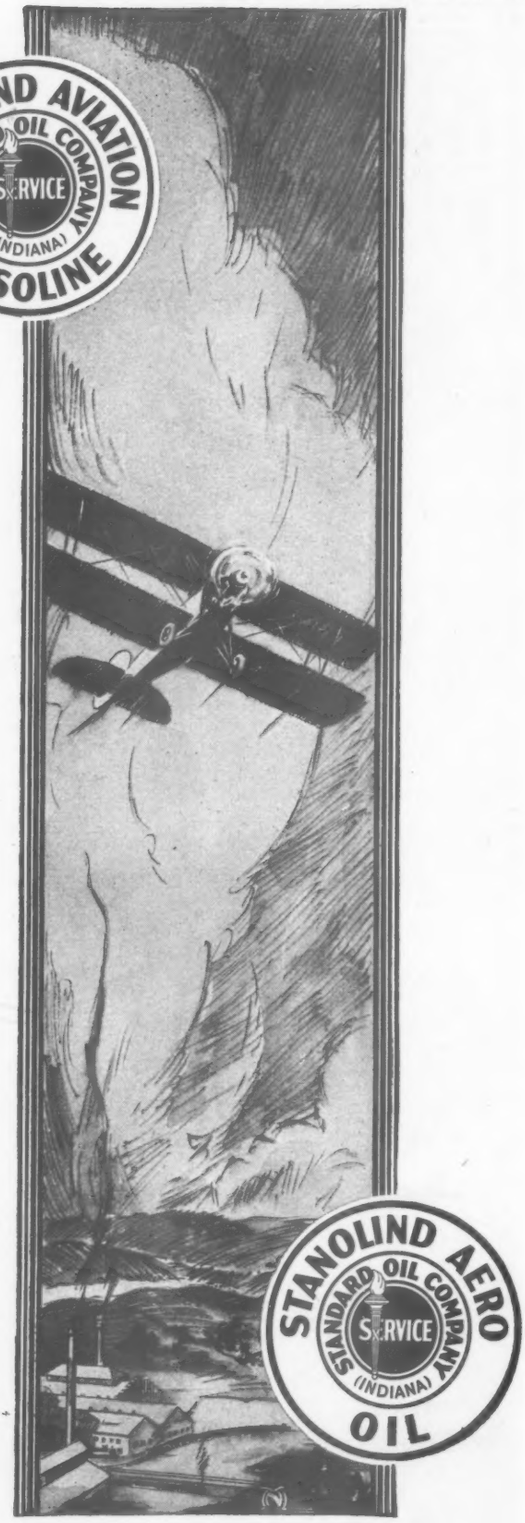
Today Stanolind Aviation Gasoline and Aero Oils are better than ever. Constant research work keeps them up to date to meet the ever changing requirements for aviation fuel and lubrication.

Stanolind Aviation Gasoline and Aero Oils are well known at midwestern airports and preferred by the majority of pilots. These men know that they can rely on Stanolind Aero Products.

See Our Exhibit at the St. Louis Aircraft Show

STANDARD OIL COMPANY
(INDIANA)

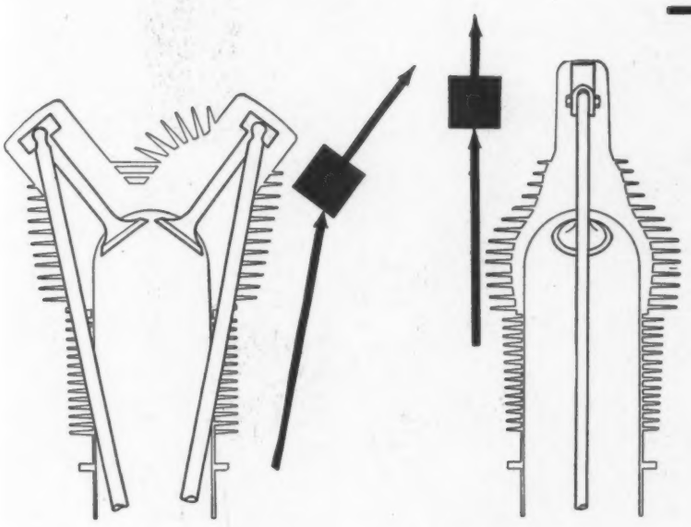
910 S. MICHIGAN AVE., CHICAGO, ILL.



For Quick Service use Air Mail

STANOLIND AVIATION PRODUCTS

THE COMET "direct action valve gear" —FOR SAFETY



Sketch showing valve actuating mechanism of typical double rocker arm engine and Comet single rocker arm engine. Arrows show direction of force applied to rocker arm compared with direction of motion desired.

WHEN you lift a load you get directly under or over it. You don't apply force at an angle. That would waste effort by pushing or pulling to one side. That's where the Comet valve gear has another advantage.

Why?

The Comet valve gear applies its effort in the direction of the movement desired. The force is not wasted in trying to twist the rocker arm to one side or in trying to tip the cylinder off its base. This reduces both load and weight, and as a result, greatly reduces wear in the bearings. Comet valve clearance adjustments need be made only at approximately 50 hour intervals—5,000 miles of flying—your motor car will hardly do better.

Then, too, the entire Comet valve mechanism—tappet, push-pull rod, and rocker arm—is positively moved in both directions by the cam. Other engines depend on the valve spring to return the system to neutral position. Thus the Comet valve springs are much lighter and carry less load, since they serve only to seat the valve itself. Less load—less wear—less maintenance—less expense.

And, above all, one valve-actuating system does the work of two. Another reason why owners of Comet engines are—

A Comet engine is on exhibit at Booths 63 and 64, Building "B", International Aircraft Exposition, St. Louis.

at ease in the air

COMET ENGINE CORPORATION

MADISON, WISCONSIN, U. S. A.

Comet aircraft engines are manufactured at Madison, Wisconsin, under the direction of the Gisholt Machine Company, for 40 years builders of the fine machine tools in use throughout the world.

PROTECTING THE NATIONAL AIRPORTS

MAKE YOUR AIRPORT PAY

YOUR Airport can be self-supporting if admission is charged and collected. But collections cannot be guaranteed unless your Airport is enclosed. With an Anchor Fence enclosure, all entrances and exits are controlled and nobody can gain admission without paying.

An Anchor Fence enclosure will pay for itself out of gate receipts. And, the exceptional durability of Anchor Fence Construction will give many years of maintenance-free service.

Have the local Anchor Fencing Specialist submit a plan and cost for enclosing your Airport.

ANCHOR POST FENCE COMPANY
Eastern Ave. and Kane St., Baltimore, Md.

Albany; Boston; Buffalo; Charlotte; Chicago; Cincinnati; Cleveland; Detroit; Hartford; Houston; Los Angeles; Mineola, L.I.; Newark; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Shreveport.

Representatives in principal cities. Consult phone directory.

ANCHOR FENCES

MADE BY THE MAKERS OF AMERICA'S FIRST CHAIN LINK FENCE

THIS SPLINED CRANKSHAFT COSTS MORE TO BUILD . . .

BUT IT MAKES A BETTER ENGINE . . .

PULL down a Pratt & Whitney engine and you find workmanship worthy of a Swiss watch. The two piece splined crankshaft is an outstanding example of this. The two sections are bolted directly through the crank pin, making for rugged strength and stiffness, contributing materially to the all-round dependability which is synonymous with the words "Wasp" and "Hornet."

THE
PRATT & WHITNEY AIRCRAFT CO
HARTFORD . . . CONNECTICUT
Division of United Aircraft & Transport Corporation

Visit the Pratt & Whitney exhibit, spaces 93, 94, 95, 96, 65, 66, 67 and 68, Building B, at the International Aircraft Exposition, St. Louis, Mo., and see the 300 H. P. Wasp Junior, Wasp and Hornet engines geared and direct drive.

Wasp & Hornet *Engines*

Manufactured in Canada by Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, Quebec; in Continental Europe by Bavarian Motor Works, Munich.

Speed
Stability
Economy

IT'S the rare combination of all three of these qualities in one airplane that makes the Davis D-1 Monoplane so out of the ordinary.

Here's a cruising speed of 85 miles per hour—with a gasoline consumption of only 4½ gallons per hour. Top speed of 101!

Here's the stability of larger and heavier planes, achieved in the D-1 by the unique wing design characteristic of all Davis Monoplanes. And with it, you'll find an eager response to controls rivalling a pursuit plane.

Here's the exceptional sturdiness and ability to stand punishment made possible by rugged all-metal construction all the way from landing gear to wing ribs. Wing spars, of course, are laminated spruce.

PERFORMANCE (*Actual*)

Type	D1—Le Blond 60	D1-K—Kinner 90
Service Ceiling	10,000 feet	14,000 feet
High Speed	101 M. P. H.	125 M. P. H.
Landing Speed	38 M. P. H.	40 M. P. H.
Cruising Speed	85 M. P. H.	105 M. P. H.
Climb	700 ft. per min.	1200 ft. per min.
Fuel Consumption at Cruising Range	4 1/2 gal. per hr.	6 gal. per hr.
Cruising Range	300 miles	400 miles
Price Complete, Fly-away	$3285	$4185

Here, in short, is a thoroughly modern two-place plane which meets equally well the demands of the private owner and the flying school. Read the performance data—write for complete information on Davis construction—fly in it—and draw your own conclusions.

DAVIS AIRCRAFT CORPORATION
RICHMOND, INDIANA

Manufactured under Department of Commerce Approved Type Certificate

D-1

DAVIS MONOPLANE

Sold under licenses covering all of the patents owned by members of the Manufacturers Aircraft Association, Inc.

$100,000 SAFETY PRIZE WINNER

Controlled
with the aid of FAFNIRS

SAFETY to a degree that makes a plane practically "foolproof" was the basis of the Guggenheim award to the Curtiss Tanager. Slotted wings and the so-called "floating" aileron were outstanding features, but every detail was designed to contribute its share towards safety.

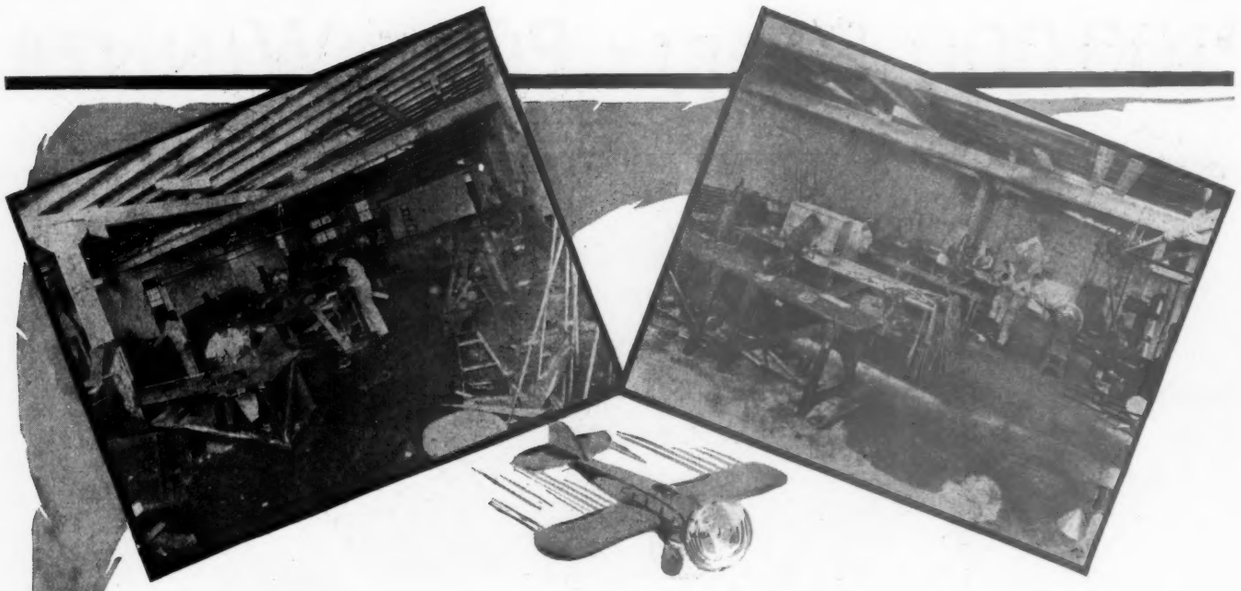
The advanced Control system which triumphed in this competition presupposed the use of ball bearings. Control pulleys, for instance, were mounted on Fafnirs to give that sensitive reliability essential in the more difficult tests.

Curtiss, appreciating the value of the Ball Bearing design, uses Fafnirs in other applications in other ships, other models. Fafnir Ball Bearings are made for every aircraft application. Send for special data sheets.

THE FAFNIR BEARING COMPANY, NEW BRITAIN, CONN.
Chicago Milwaukee Detroit Newark Cleveland Philadelphia

FAFNIR
BALL BEARINGS

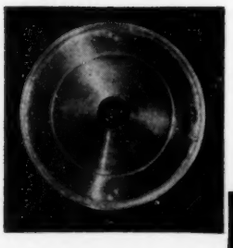
THE MOST COMPLETE LINE OF BALL BEARINGS IN AMERICA



Specializing

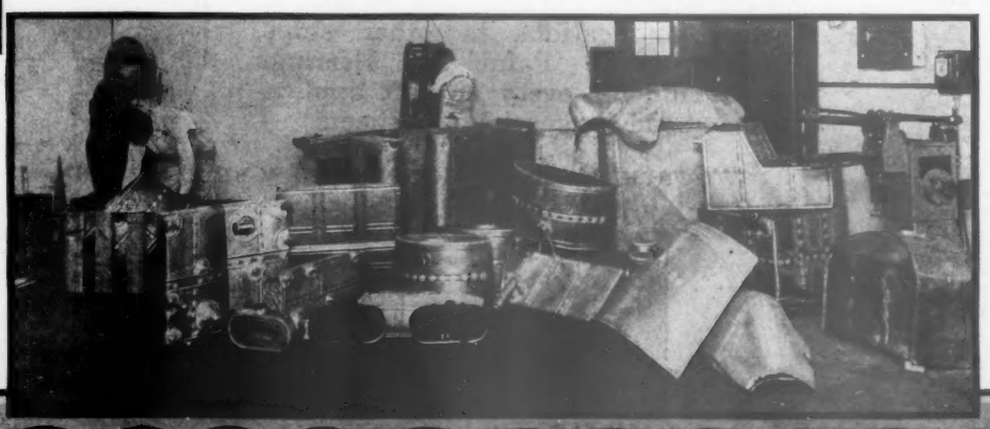
SPECIALIZING in the manufacture of tanks and cowlings and motor parts and the volume of our business permits a greater degree of accuracy and finer workmanship, at a price per unit below the production costs on like products manufactured by individual aircraft producers.

Here you will find a modern plant well equipped to serve you with an engineering staff composed of specialists working on airplane parts strictly and whose reputation for doing good work places them among the leading authorities in their particular phase of aircraft design and manufacture.



There is no satisfactory substitute for experience and equipment in designing and manufacturing tanks and cowlings.

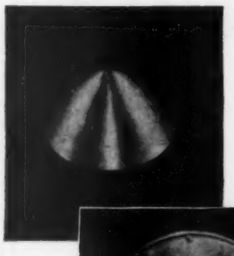
Like "flying hours" you either have them or you don't.



in Parts . . .

If you believe that the design and manufacture of tanks and cowlings and smaller parts is just as vital to efficiency and structural strength as the principal components which lend themselves to ready inspection, you will find our company your logical source of supply.

We invite you to visit our plant while attending the St. Louis Air Show, or advise us of your requirements and we will be pleased to serve you.

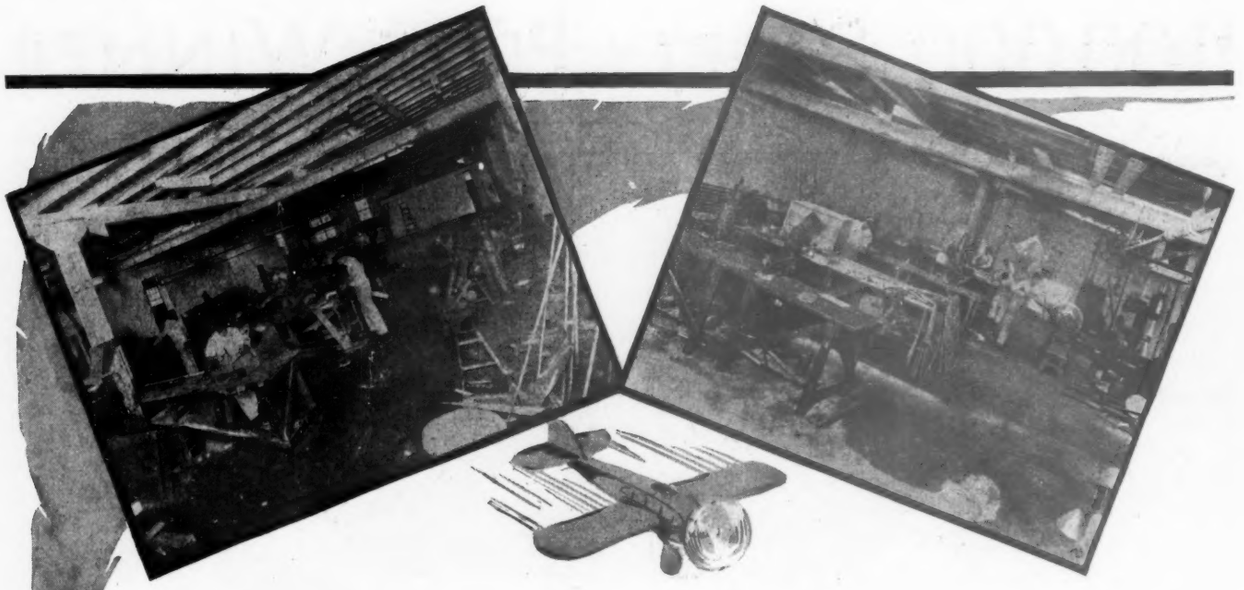


STUART AERO PRODUCTS, INC.

Thirteenth and Rutger ST. LOUIS, MO.

Your safeguard in airplane engine building or replacement depends on whether those "little things" are safe before they are installed.

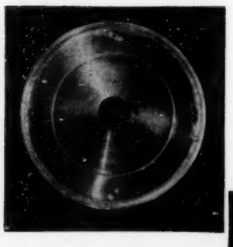
All Stuart parts are true to pattern, uniform in quality, and thoroughly dependable.



Specializing

SPECIALIZING in the manufacture of tanks and cowlings and motor parts and the volume of our business permits a greater degree of accuracy and finer workmanship, at a price per unit below the production costs on like products manufactured by individual aircraft producers.

Here you will find a modern plant well equipped to serve you with an engineering staff composed of specialists working on airplane parts strictly and whose reputation for doing good work places them among the leading authorities in their particular phase of aircraft design and manufacture.



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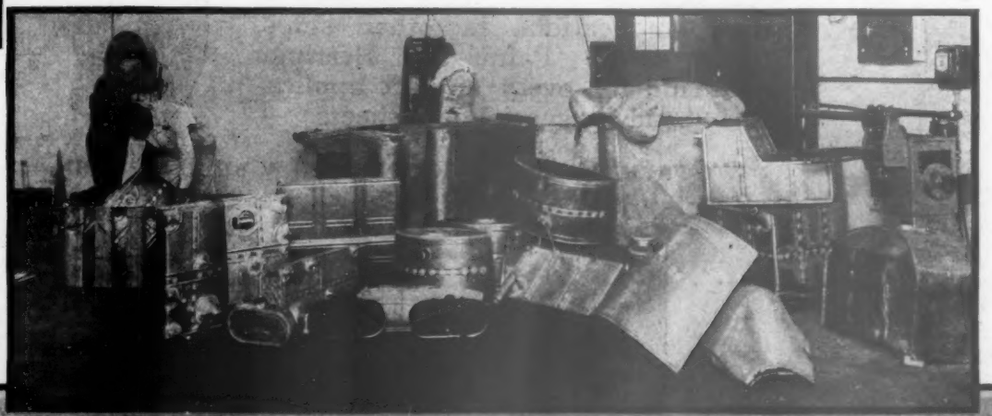

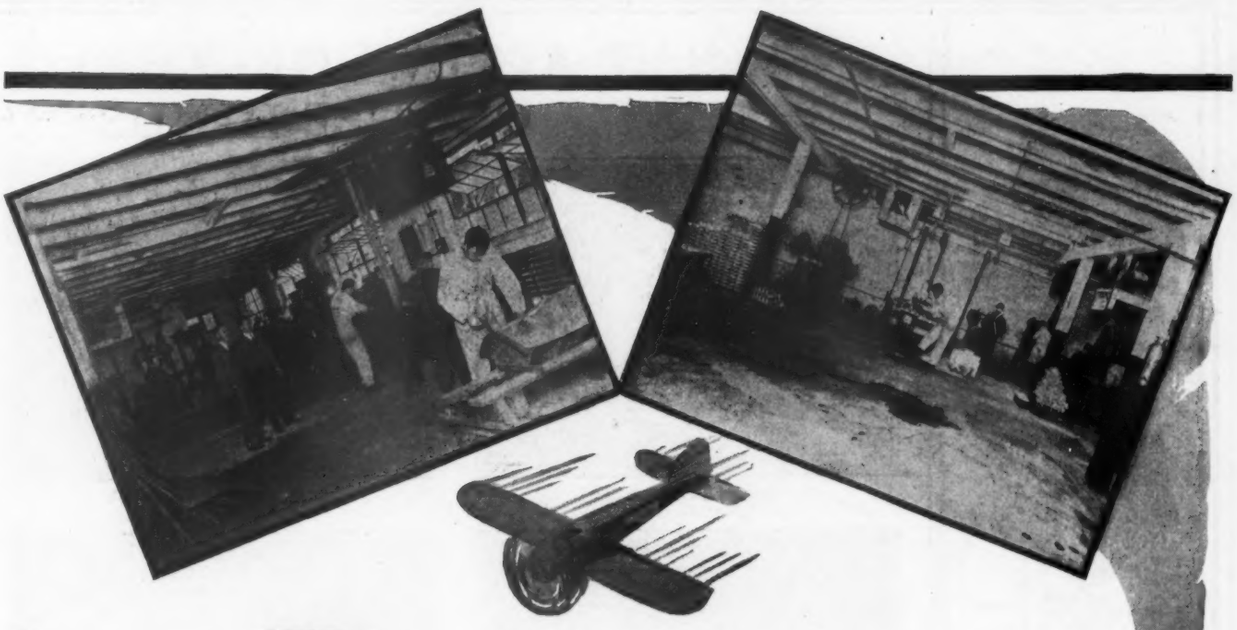

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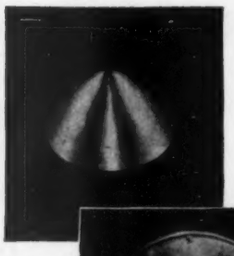

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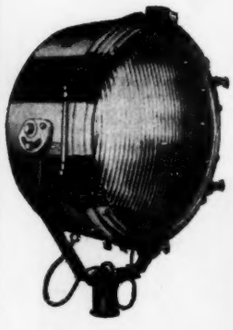
Type DCB-24
Revolving Beacon

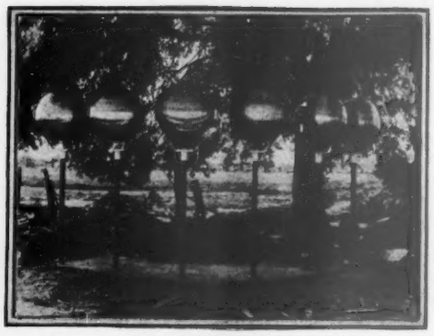


Type DCE-24
Airport Floodlight

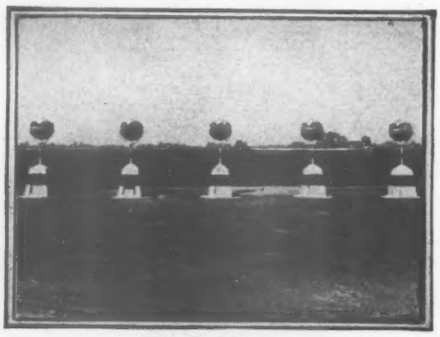
Type MSA-1
Hangar Floodlight

C-H 510

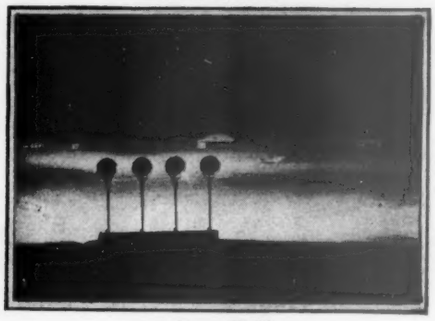
A FEW OF THE CROUSE-HINDS



Scenic Airways, Inc.
Phoenix, Ariz.

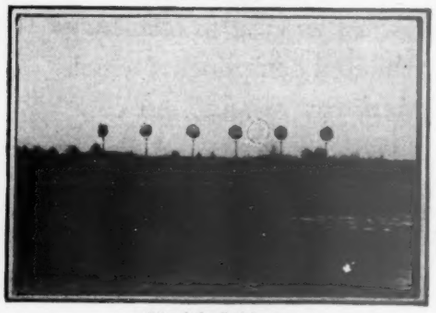


Municipal Airport
Fresno, Calif.



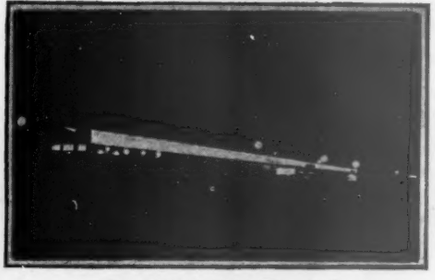
Clover Field
Santa Monica, Calif.

Logan Field
Baltimore, Md.

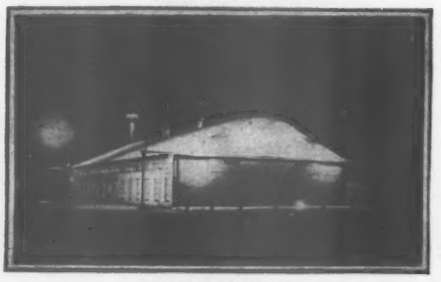


Municipal Airport
Pontiac, Mich.

Municipal Airport
Rochester, N. Y.



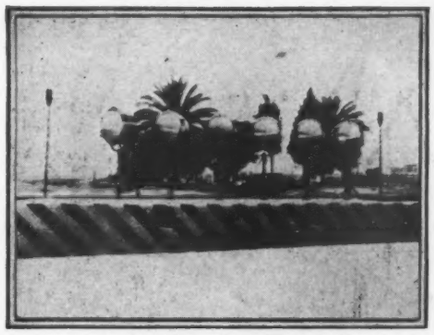
Grand Central Air Terminal
Glendale, Calif.



Municipal Airport
Syracuse, N. Y.

CROUSE
ESTABLISHED
SYRACUSE,
SALES
BOSTON NEW YORK DETROIT PHILADELPHIA ATLANTA CHICAGO MILWAUKEE ST. LOUIS

MANY AIRPORTS USING LIGHTING EQUIPMENT



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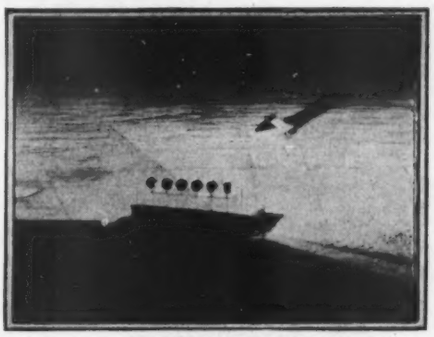
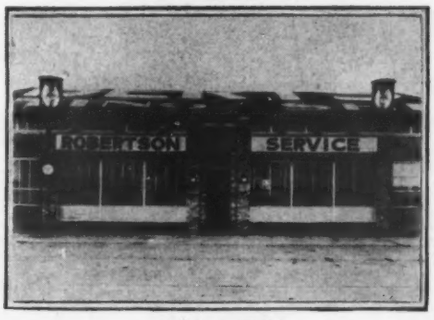


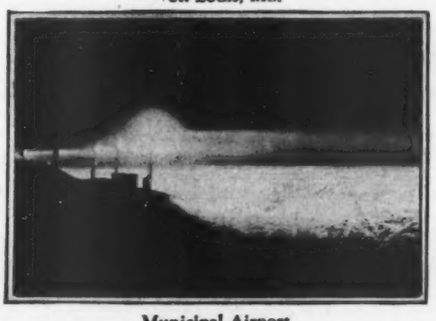
Grand Rapids Airport
Grand Rapids, Mich.

Municipal Airport
Abilene, Texas

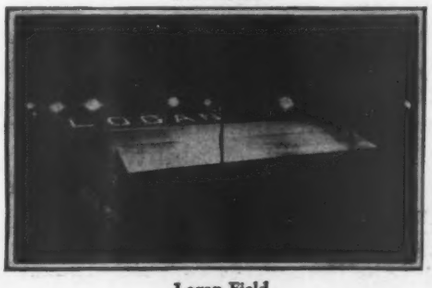


Lambert Field
St. Louis, Mo.

Transcontinental Airport
Toledo, Ohio

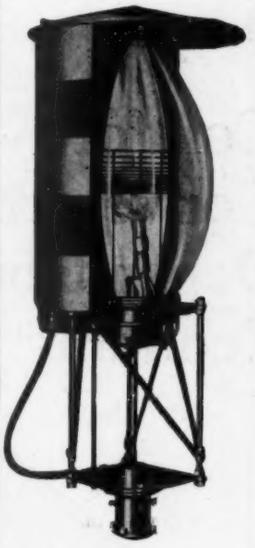


Municipal Airport
Albany, N. Y.



Logan Field
Baltimore, Md.

Scenic Airways, Inc.
Phoenix, Ariz.



Type AKP-24
180° Airport Floodlight

Type DCE-14
Ceiling Projector

Ceiling Height
Indicator

-HINDS

1887
N. Y., U. S. A.

OFFICES
CINCINNATI CLEVELAND MINNEAPOLIS PITTSBURGH LOS ANGELES SAN FRANCISCO DALLAS SEATTLE

The New "Gee Bee"

The answer to the growing demand for

Comfort
Convenience
Dependability
Economy

DESIGNED, built and service-tested for one year, by an organization that appreciates the needs of the flying public. The new Gee Bee now emerges a finished product, perfected in details and second to none in performance.

No more cross country with an aching back and one foot sound asleep. No more "goggle headaches" —you need wear no goggles. Gas up without leaving the seat or stopping the engine. Carry two suitcases and all your much needed "junk." Taxi down-wind or cross-wind in any wind. Install dual stick, rudders and throttle in two and six-tenths seconds and unstick in less. Land in your doubtful but inviting back yard and know that your landing gear and Tail-wheel are built to LAND ON. When you feel a loop or a roll coming on, pull back the stick, roll out at the top and still "have plenty left."

Controls are unbelievably sensitive yet very light. The stick is horizontal giving a clear and roomy cockpit. The brakes are connected to the stick and rudder pedals. The stabilizer has a micrometer adjustment for perfect trim or it may be used to fly with. Stability is unsurpassed. Ship will fly hands and feet off and when you cut the motor it assumes a 60 m.p.h. glide.

Ideal for Training. As a sport plane The Gee Bee gives the keenest kind of flying pleasure. See us at St. Louis or write for details.

Price: Land Plane $3985, skiis $65.00 extra.
Edo equipped Sea Plane $4685.

Specifications and Performance

Type—Two place side by side, sport biplane.

Wings—197 sq.ft. Clark Y. 33 in. overhang, 27 in. stagger, 52 in. gap, 45 in. chord.

Landing Gear—7 in. travel in oil, last 2 in. on rubber shock cord. Bendix brakes. Adapted to quick change to floats or skiis.

Fuselage — Welded chrome molybdenum tubing.

Tail Surfaces—Exceptionally large, thick, rigid.

Power—Kinner K-5, 113 hp. at 1,880 r.p.m.

Controls—Horizontal stick, quick detachable duals, brake control through stick and rudder pedals, quickly adjustable micrometer stabilizer adjustment, releasable dual throttle.

	Land Plane	Sea Plane
Wt. empty	1050	1185
Disposable Load	600	600
Gross Wt.	1650	1785
High Speed	111	108
Landing Speed	39	40.5
Cruising (1650)	100	95
Service Ceiling	14000	12300
Initial Climb	1050	870
Cruising Range	450	400

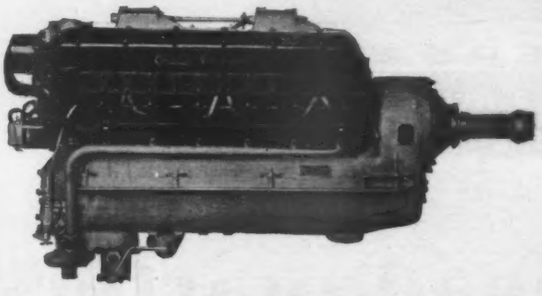
Gee Bee AIRPLANES

Granville Brothers Aircraft Inc.
Springfield, Mass.

PRESENTING —

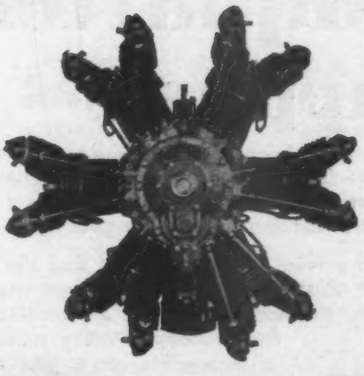
THE 1930 CURTISS AIRCRAFT ENGINES

A COMPLETE line of engines for every commercial aircraft. Thoroughbreds all—latest members of a distinguished family that have been making aeronautical history for twenty-five years. Built to exacting Curtiss standards in the country's largest and most modern aircraft engine factory—and backed by a service organization that covers the entire United States. See them at the International Aircraft Exposition, St. Louis.



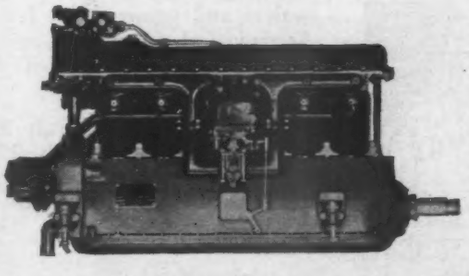
CONQUEROR—600 HORSEPOWER

12 Cylinder, liquid cooled, Vee type, direct drive or geared models. Incorporates basic design principles of the famous Curtiss D-12. Its tremendous power, low frontal area and unfailing reliability have made it a favorite with air transport and mail operators.



CHALLENGER—185 HORSEPOWER

Six cylinder, air-cooled radial with two-throw crankshaft. New U. S. Department of Commerce rating of 185 H.P. at 2000 R.P.M., new smoothness, quietness of operation, and the same old reliability that brought to it the World's Endurance Record.



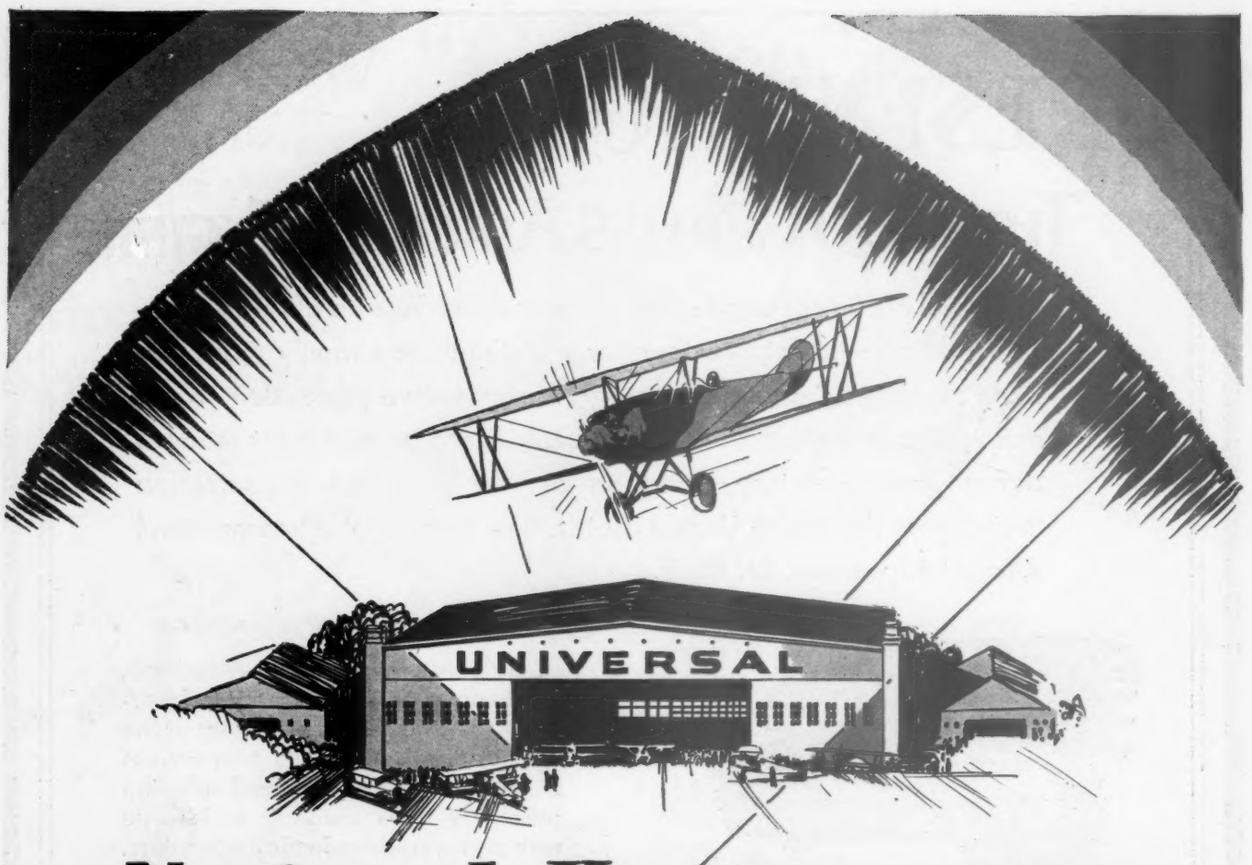
CRUSADER—125 HORSEPOWER

Six cylinder in line air cooled inverted type. Lightness and simplicity of air cooled engines combined with low frontal area of in line construction. Especially desirable for smaller sport and training aircraft. Watch for production announcement.

CURTISS AEROPLANE & MOTOR CO., Inc.

Offices: Garden City, N. Y. · Factories: Garden City, Buffalo, N. Y.

A DIVISION OF CURTISS-WRIGHT CORPORATION



National Headquarters *for* Aviation Supplies . . . .

A WAREHOUSE for the industry—so is the Universal Aviation Corporation considered by those who have had occasion to draw upon this vast supply depot for various aeronautical needs. Practically anything and everything pertaining to aviation is carried in stock, ready for immediate shipment.

Bolts, nuts, instruments, fabric, dope, engines and engine parts, and other supplies for manufacturers and individuals, as well as all manner of flying equipment, can be found in the store rooms of this supply depot. Tremendous purchasing power has made it possible to secure this material at lowest possible prices. Often the user of aircraft supplies can purchase from Universal at prices far less than if dealing direct with manufacturers . . . Delivery is prompt.

SERVICE

Every item carried meets A N specifications or has been accepted as standard through general commercial usage. Every item is guaranteed to give full satisfaction or purchase price is refunded. Send for latest catalog just off the press.

At our service hangar you will find the finest stop-over service available. Heated storage space, skilled mechanics, prompt service and a complete stock of parts for practically every motor are available at reasonable rates. As authorized parts dealers and repair depot for the Wright Aeronautical Company, you can secure parts and competent service on Whirlwind Motors.

The International Aircraft Exposition at St. Louis, Feb. 15 to Feb. 23, affords an opportunity to get acquainted. Visit the Universal Aviation Corporation's exhibit in Building "A," booths 136, 137 and 138.

N570R3

ALL AERONAUTICAL SUPPLIES

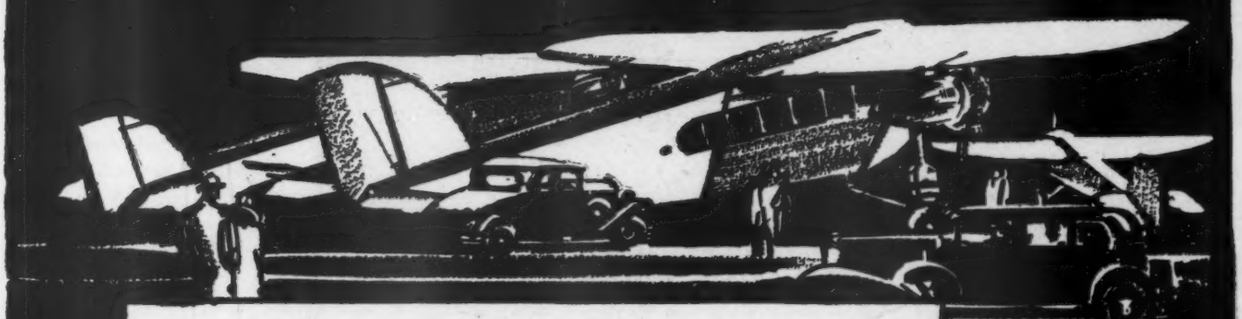
UNIVERSAL AVIATION CORPORATION

ROBERTSON DIVISION

LAMBERT-ST. LOUIS AIRPORT, ANGLUM, MISSOURI

Gulfpride Oil

AMERICA'S FINEST AVIATION OIL



GULFPRIDE OILS

provide to the highest extent these desirable features necessary for satisfactory operation of Aviation Motors.

1. **Oil economy—due to their extremely long life; resistance to oxidation and low volatility.**
2. **Lowered maintenance—because of proper lubricating qualities and very low carbon and gum forming characteristics.**
3. **Proper lubrication—a grade for each motor and condition of operation.**
4. **High quality—exhibit minimum change of body under extremes of temperature.**

GULFPRIDE OILS are approved by leading Aviation Engine Builders.

Manufactured for Aviation Engine Lubrication in five grades or body designations:

Gulfpride Oil 75 **Gulfpride Oil 120**
Gulfpride Oil 100 **Gulfpride Oil 150**
Gulfpride Oil 200

GULF REFINING COMPANY

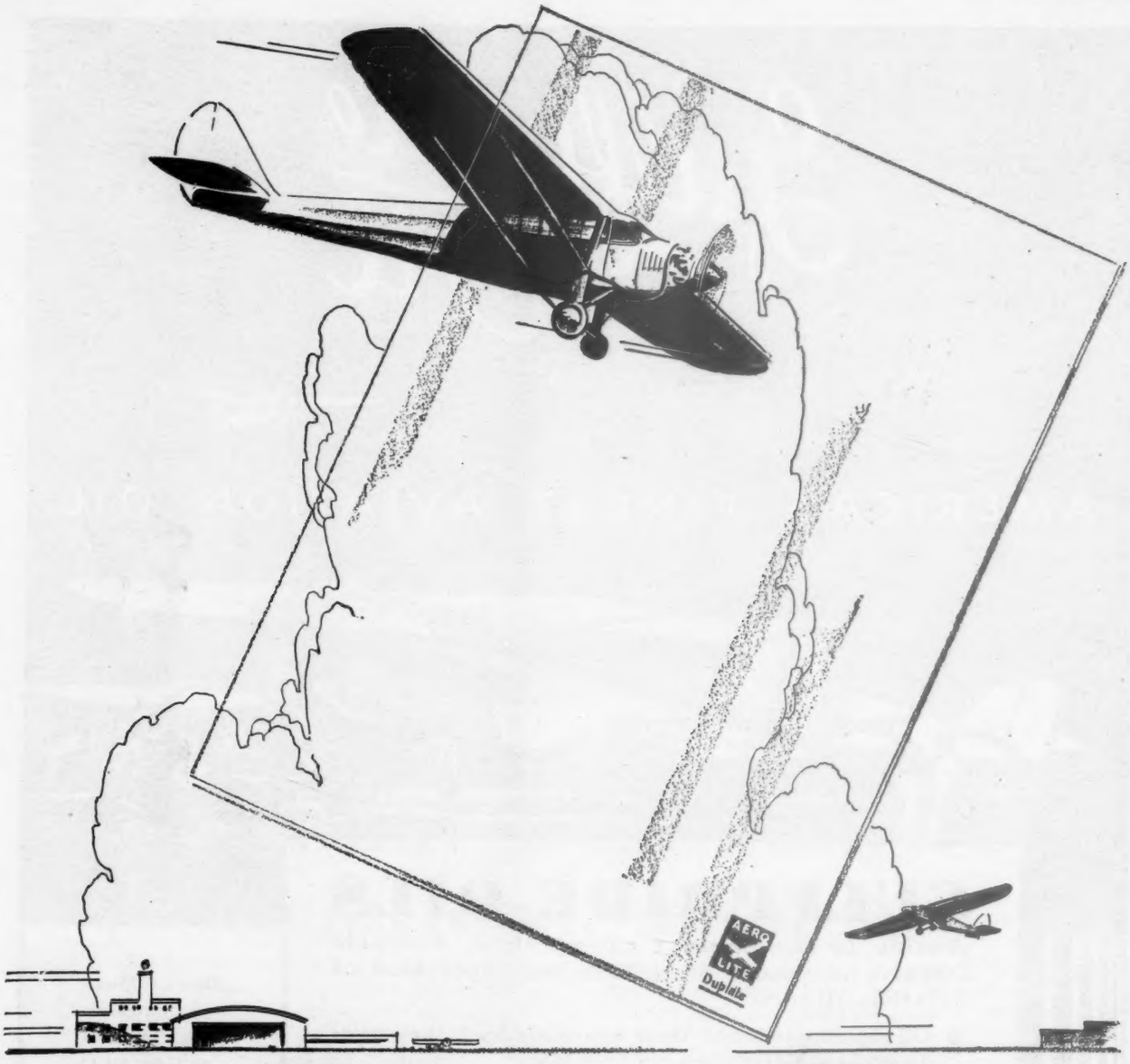
***General Offices:* PITTSBURGH, PA.**

District Offices
BOSTON
NEW YORK
PHILADELPHIA
LOUISVILLE
ATLANTA
NEW ORLEANS
HOUSTON

•

Refineries
BAYONNE, N. J.
PHILADELPHIA, PA.
PORT ARTHUR, TEX.

GULF



3 Thicknesses...3 Weights

AERO LITE — Made by Duplate Corp., Pittsburgh

Thinnest laminated glass made. 1/8 to 3/32 in. thick. Weight 24 to 36 oz. per sq. ft.

Duo-lite — The Unbreakable Glass

Finest quality sheet glass. 3/32 in. thick. Weight 45 ounces per square foot.

Duplate — Duplate Corporation

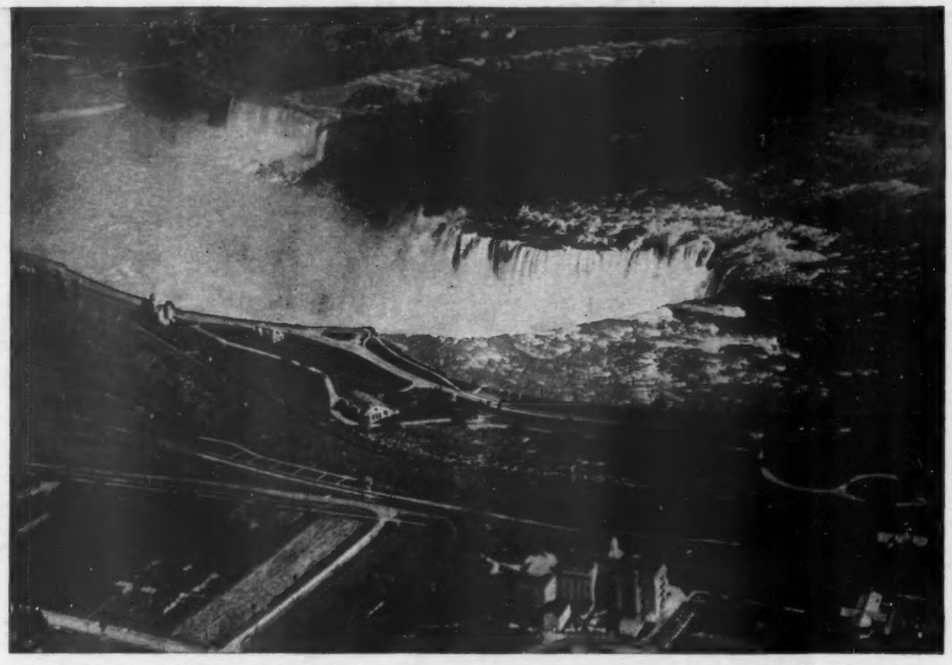
Finest, thinnest plate glass. 1/4 in. thick. Weight 48 ounces per square foot.

WHATEVER your requirement in laminated glass, the Duplate Corporation has a glass to meet it—a non-shatter glass developed especially for your purpose. Three types, each made by the special Creighton process, which establishes new standards in laminated glass. All three types—as well as special *bent* laminated glass for cockpit windshields—may be secured from the warehouses of the Pittsburgh Plate Glass Company, located in all principal cities.

Duplate Corporation

Fly to *Toronto*

with Colonial Western Airways and really see Niagara



In cities having waterfronts Sikorsky Amphibions can be landed so close to the business center that it is a matter of 5 or 10 minutes from desk to plane. Photo ©Major Hamilton Maxwell —from Underwood & Underwood.

Between Buffalo and Toronto the speedy ships of the Colonial Airways swing a scenic circle above the American Falls, the Bridal Veil and the Horseshoe. Almost equally beautiful are Lake Ontario and the Niagara River.

Until you have flown from Buffalo to Toronto with Colonial Western Airways you have never really experienced the full beauty and luxury of travel. Operated with all the skill and precision that come with long months of successful scheduled flying, the line justifies the utter confidence inspired by its men . . . and its ships.

Typical of its deep concern for the comfort of its patrons is Colonial's use of Sikorsky Amphibions. With cabin interiors worthy of the finest yachts and an unusual freedom from noise and vibration, these ships put you wholly at your ease.

And yet this comfort is not attained at any sacrifice of speed or performance. Sikorsky Amphibions are powered with two 420 H. P. "Wasp" engines, and fly at over two miles a minute with full load.

Further, by a touch of a conveniently located control, the pilot can convert the Sikorsky into a landplane in a matter of seconds.

Here indeed is a great ship to fly and a marvelous craft in which to be a passenger!

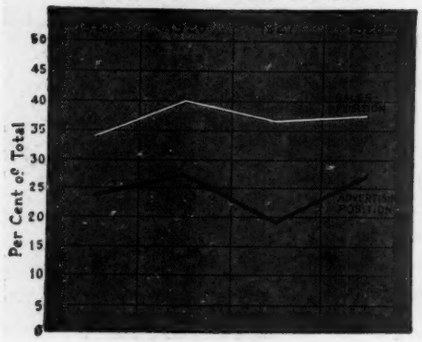
The Sikorsky Amphibion is powered with two 420 H. P. Wasp engines and has a cruising speed of 110 miles an hour at full load. Descriptive literature will be sent on request. Sikorsky Aviation Corporation, Bridgeport, Connecticut. Division of United Aircraft & Transport Corporation.

SIKORSKY AMPHIBION

This is one of a series of advertisements directed originally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility.

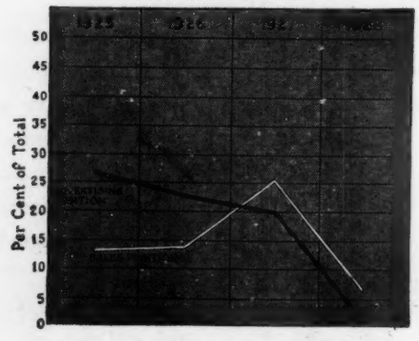
Does advertising schedule have anything to do with sales?

MANUFACTURER SMITH



These charts, compiled by McGraw-Hill, present the sales and advertising history of two competitors making the same kind of product and selling it to the same market through the same two publications.

MANUFACTURER BROWN



The white curve shows each manufacturer's share of total sales in the particular industry. The black curve shows how much of the total competitive advertising (on a page basis) each manufacturer used in this market.

Yes, according to the experience of Manufacturer Smith whose sales staff from top to bottom is advertising minded. Smith's schedule has been consistently maintained over a period of years in every issue of two McGraw-Hill publications.

* * * *

Yes, according to the experience of manufacturer Brown whose sales executives are not so advertising minded. Brown's schedule in the same publications was consistent up to a certain point and then sharply curtailed. He believed that product quality would take care of most of his future sales.

Printers' Ink says succinctly: "The way to make money by using advertising is to use it — not to fiddle with it." Do not these two experiences from the industrial field endorse this as something stronger than theory?

McGRAW-HILL PUBLICATIONS

New York Chicago Cleveland Detroit St. Louis
Philadelphia Greenville San Francisco
Boston London

J-M SERVICE . .

TO AIRPORTS AND AIRWAYS

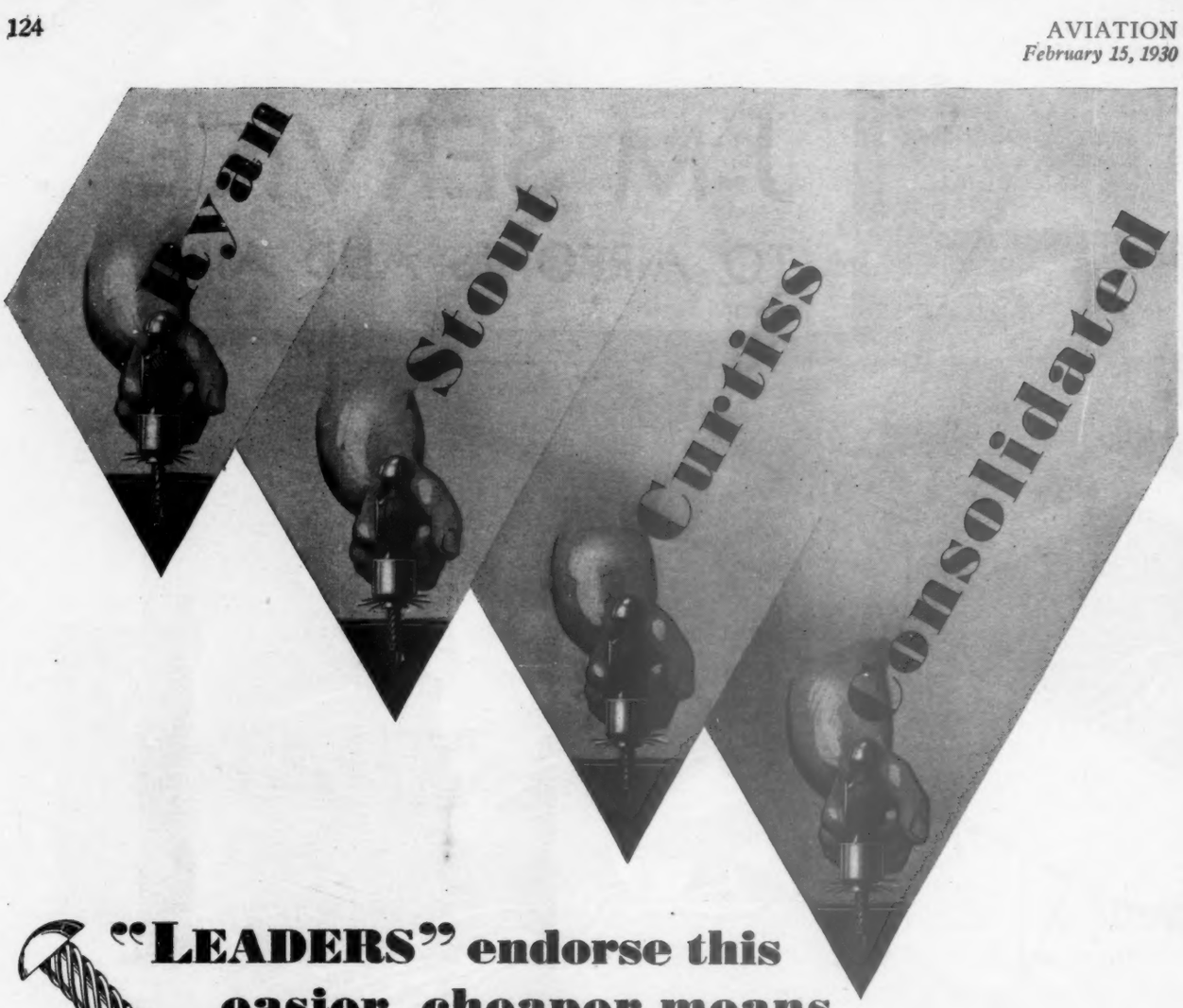
TODAY the world turns to the air for new speed in transportation. Different as is the airplane from the train there are many points of similarity in the facilities used in connection with their economical operation. Our fifty years' association with the railroads makes it possible for Johns-Manville to offer to the Aviation Industry a specialized experience in supplying materials designed to insure economy, comfort and safety in air transportation service.

In the construction of airports, Johns-Manville offers building materials that insure permanence, fireproofness and low maintenance. Transite, the imperishable building material, is ideally suited for airplane shelter. J-M Built-up Roofing, covering the hangar of the Los Angeles at Lakehurst, has proved its ability to meet the exacting requirements of this service.

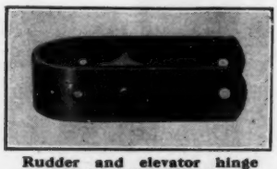
For airplanes, Johns-Manville is supplying insulation, sound-deadening materials, brake lining, packings for shock absorbers and other products which help increase operating efficiency, improve passenger comfort and reduce cost. The services of our engineering staff are freely at your disposal.

Johns-Manville

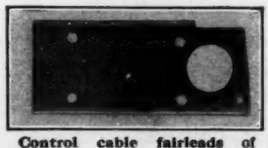
SERVICE TO TRANSPORTATION



"LEADERS" endorse this easier, cheaper means of making permanent fastenings



Rudder and elevator hinge assembled by Consolidated with these unique Screws instead of rivets—allowed the use of a thinner gap filler rubbing block—resulting in a worthwhile aerodynamic improvement.



Control cable fairleads of Bakelite are fastened into the Consolidated fuselage with these Screws. A difficult and costly tapping operation is thus avoided.

To plug oil drain holes. Curtiss and many others find that these Screws offer a much easier, speedier method than soldering, and result in a neater and better job.

Adoption of Hardened Metallic Drive Screws by such prominent aircraft manufacturers justifies our claim that—

1. These unique Screws will greatly reduce the time, labor and cost of making permanent fastenings to iron, brass, aluminum, steel, Bakelite, etc.

2. These Screws make fastenings which are equally as secure as machine screw fastenings—with the advantage that vibration and severe service will not loosen a Hardened Metallic Drive Screw.

Make your fastenings this easiest —cheapest way

You need only hammer a Hardened Metallic Drive Screw into a drilled or formed hole. No costly, time-wasting tapping. This unique Screw cuts its own thread in the material as it is driven, binding the sections tightly together.

What other way of making permanent, *secure* fastenings is so easy, speedy, and economical?

Test them, free

See what they will save you

Scores of manufacturers of aircraft and equipment have improved design, cut costs and speeded up production by using these Screws in place of machine screws, escutcheon pins, rivets, etc.

A test on your own work will show what they will save you. We'll furnish proper samples for trial—just tell us what you want to fasten.

PARKER-KALON CORPORATION
Dept. M. 192-200 Varick St., New York, N. Y.

PARKER-KALON
TRADE MARK
HARDENED METALLIC
REG. U.S. PAT. OFF.
DRIVE SCREWS
PAT. JAN. 29, 1924-No. 1482151-OTHERS PENDING

Model
D-29 A
Kinner
Powered

AGAIN—
NEW STANDARD
fills the bill ! ! !

WHEN the wintry winds of 1928 blew cold, the boys moved up closer to the old wood-burners, fought again "The Battle of the I-Want-One-Foot-On-The-Ground Passenger," and moaned in unison: "We want a ship that can make some money."

New Standard came to the rescue. It brought out the now-famous Model D-25—4 passengers and pilot—open cockpit—Whirlwind 225 hp.—in and out of the tough fields—the passengers lined up, the boys grinned and—"Oh, how the money rolls in."

"It fills the bill," they hurrahed as they busted records—the ones that count—the dollars and cents records.

Now, New Standard "fills the bill" again with the Kinner powered Model D-29A, the trainer that is a trainer. It's the safest training plane ever built.

And how it is built! Duraluminum open sections in the fuselage, riveted and bolted together—double flying and landing wires throughout—real instruments and controls—tough, husky, dependable—safe enough for the wobbly solo birds; tough enough for outside loops; good enough for the United States Navy. It's buying them already.

Better line up with New Standard and make some money. Put these husky trainers to work and write that last figure on the balance sheet in black instead of red.

But be sure and fly that trainer.

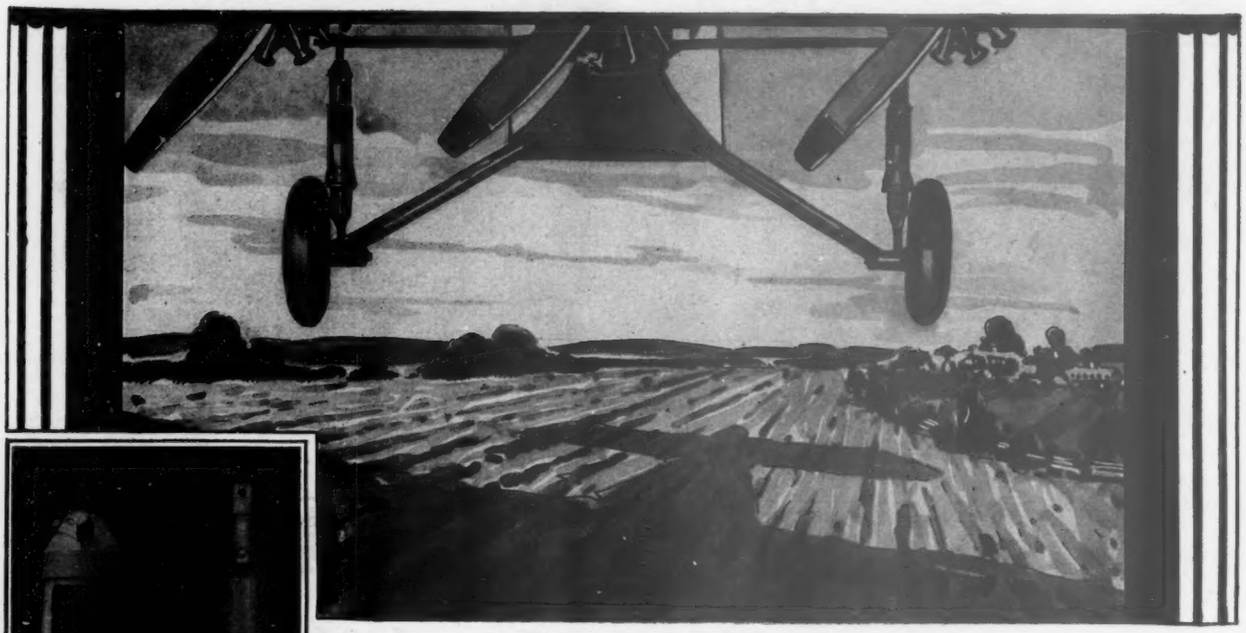
It's all that an airplane should be!

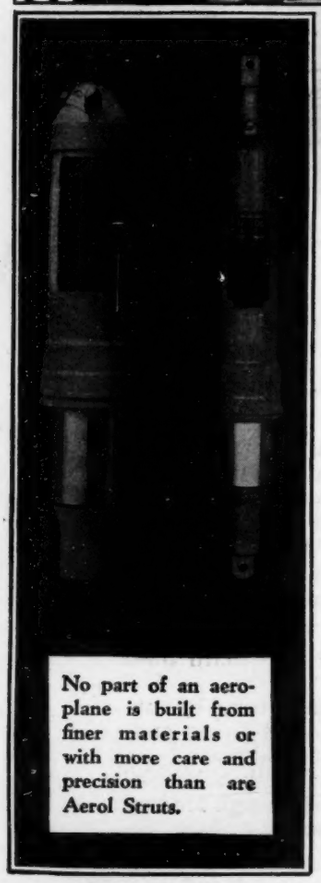
(For profits in "short-hops," remember the D-25. Get one and grab your share of the 1930 passenger business.)

We have a sport ship ready, too. How about representing New Standard in your territory? Write or wire the factory or meet us at the St. Louis show.

NEW STANDARD AIRCRAFT CORP.
PATERSON, N. J.

Changing Emergency Landings from Crises to Incidents . . .





No part of an aeroplane is built from finer materials or with more care and precision than are Aerol Struts.

THE increased acceptance of flying rests upon better control of the plane while being landed under emergency conditions.

Such performance depends upon the plane's minimum flying speed and its landing gear. Manufacturers owe it to their future and to the pilot and the flying public to give their planes maximum landing performance.

That is why an increasingly large group of plane manufacturers have standardized on Aerol Oleo-Pneumatic Landing Struts. Their presence under the plane changes the vast majority of emergency landings from crises to incidents and establish unequaled confidence on the part of the pilot.

The telescoping action of these powerful and efficient cylinders absorbs initial impact, eliminates "crow-hopping" and shortens the roll.

Aerol Struts are made in the Military Type of extreme service and the commercial type for ordinary operation. Complete information will gladly be sent on request.

Aerol Struts are manufactured by The Cleveland Pneumatic Tool Company, Cleveland, Ohio.

ASK THE PILOTS WHO LAND ON THEM

AEROL shock absorbing STRUT

BURNELLI TRANSPORTS

Transports of 20-passenger capacity now in production. Exclusive Burnelli design combines patented features giving unusual advantages. Burnelli transports are noted for—

SPEED. With 600 hp. Wright Tornado engines, high speed is 144, cruising 120 and landing speed 55 miles per hour—

COMFORT. Cabin is 12 feet wide, 5½ feet high and 18 feet long. Passengers ride in adjustable armchairs and have twice the room found in ordinary air transports—

SAFETY. Plane maintains speed of 100 miles an hour on one motor. Gliding angle is 1 to 11. Engines accessible for repairs while in flight owing to position in nose of fuselage.

ECONOMY. Airfoil fuselage has lift of 5 pounds per square foot eliminating all "body drag." High cruising speed may be maintained on reduced horsepower as result. Flat plate instead of corrugated lessens skin resistance.

STRENGTH. Entire structure engineered to have extreme excess strength factors. Engine mounts and main bulkhead give passengers protection.

LOAD. With empty weight of 9,367 pounds transport carries total disposable load of 8,140 pounds.

NOTE—Equipped with 750 hp. Fiat engines transport has high speed of 158, cruising speed of 130 and landing speed of 55 miles per hour. With Wright Tornado engines the cruising range is 1,000 miles—with Fiat engines 1,200 miles.

DETAILED INFORMATION FROM

UPPERCU-BURNELLI AIRCRAFT CORPORATION

KEYPORT, N. J.

BUILDERS OF LINDBERGH'S RYAN "SPIRIT OF ST. LOUIS"

The New RYAN FOURSOME

THE ROOMIEST, MOST LUXURIOUS, 4-PLACE CABIN PLANE EVER OFFERED

The comfortable cabin of the Foursome reflects in every detail the new luxury which Ryan has introduced to air travel. The Foursome will be displayed at the International Aircraft Exposition.

In the Foursome, Ryan presents a de luxe 4-place ship that sets a new standard for light cabin monoplanes. Exceptionally roomy and luxuriously appointed, the new model C-1 offers the latest features in aeronautical design together with characteristic Ryan performance.

The cabin of the new Ryan Foursome is finished as completely and as artistically as the interior of a custom motor car. The automobile-type fittings, the rich upholstery and roomy seats—one of which is convertible into a lounge—provide a new degree of luxury in air travel

A host of new improvements are incorporated in the Foursome. A 2-piece wing which gives greater stability—a stabilizer adjustment which permits extra-fine settings—direct connected push-pull type elevator controls and pedal rudder controls—are a few of the many advanced construction features.

Powered by a 225 Horsepower Wright Whirlwind Engine, the new Ryan Foursome has a top speed of 130 miles per hour and cruises at 110. With full load —1300 pounds—it has a range of 625 miles. And in take-off and climb it maintains the brilliant reputation established by Ryan planes.

$10,900
Flyaway, St. Louis

Ideally designed for private pilots the new Ryan Foursome is equally suitable for commercial purposes. Specifications and complete performance data will gladly be sent upon request.

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and out of danger's grasp

—Over telephone wires that stretch across your path—over buildings or trees that rush at you from the far end of emergency landing fields. With the extra thrust and climb of a Paragon Propeller whirling on the nose of your ship—you're safe—and can laugh as you climb. It's those few extra revs in the Paragon Propeller that have pulled you over in safety.

Made of selected birch, with laminations carefully weighed, balanced and matched, for absolute elimination of vibration—blade outline that provides a pitch variation for quick take-off and climb—Paragon Propellers stand ready to give you lasting quality, beautiful appearance and thrilling performance—all at a welcome price.

There are Paragon dealers at most of the principal airports. *Descriptive leaflet sent upon request.*

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FORGET THE WEATHER
when it comes to propellers . . .

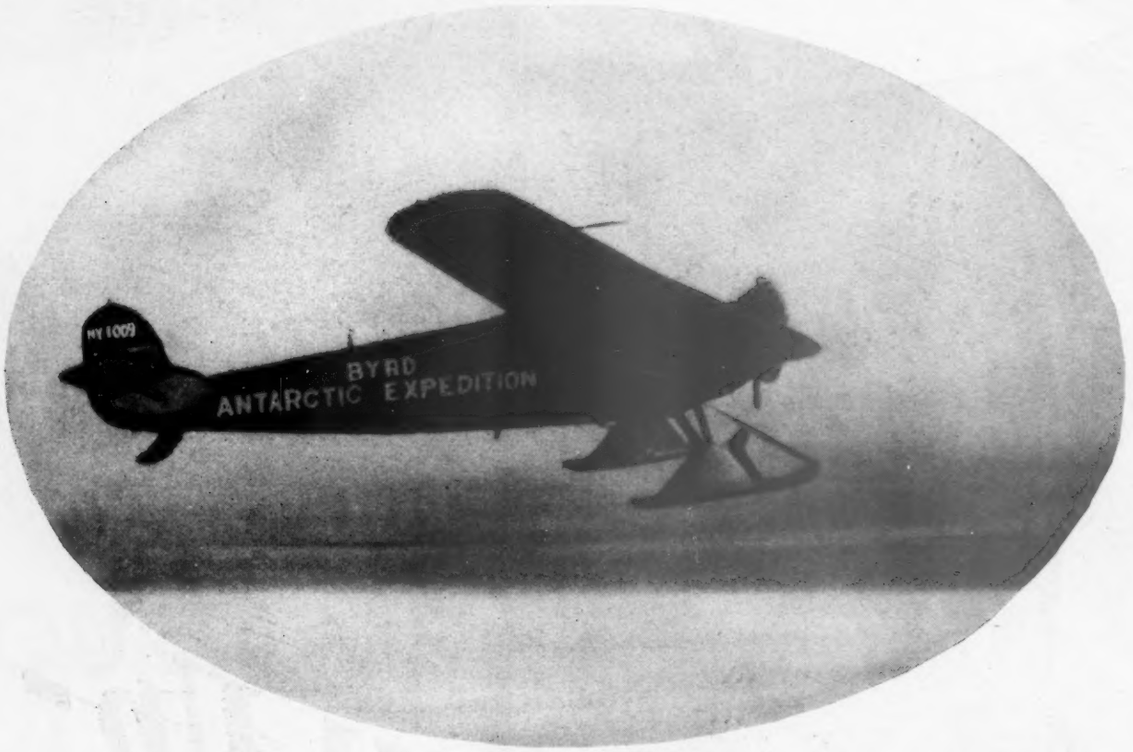


Photo copyright 1929 Paramount Famous Lasky Corp.

This Wasp engined Fairchild used for short exploration by the Byrd Antarctic Expedition is equipped with a Hamilton Standard Propeller

●● WITH the development of the metal propeller came a great extension of the possibilities of all weather flying. Rain, snow, heat or cold are all fair working conditions to the modern metal propeller. You can depend on a Hamilton Standard to deliver complete satisfaction in any sort of weather in which flying is possible.

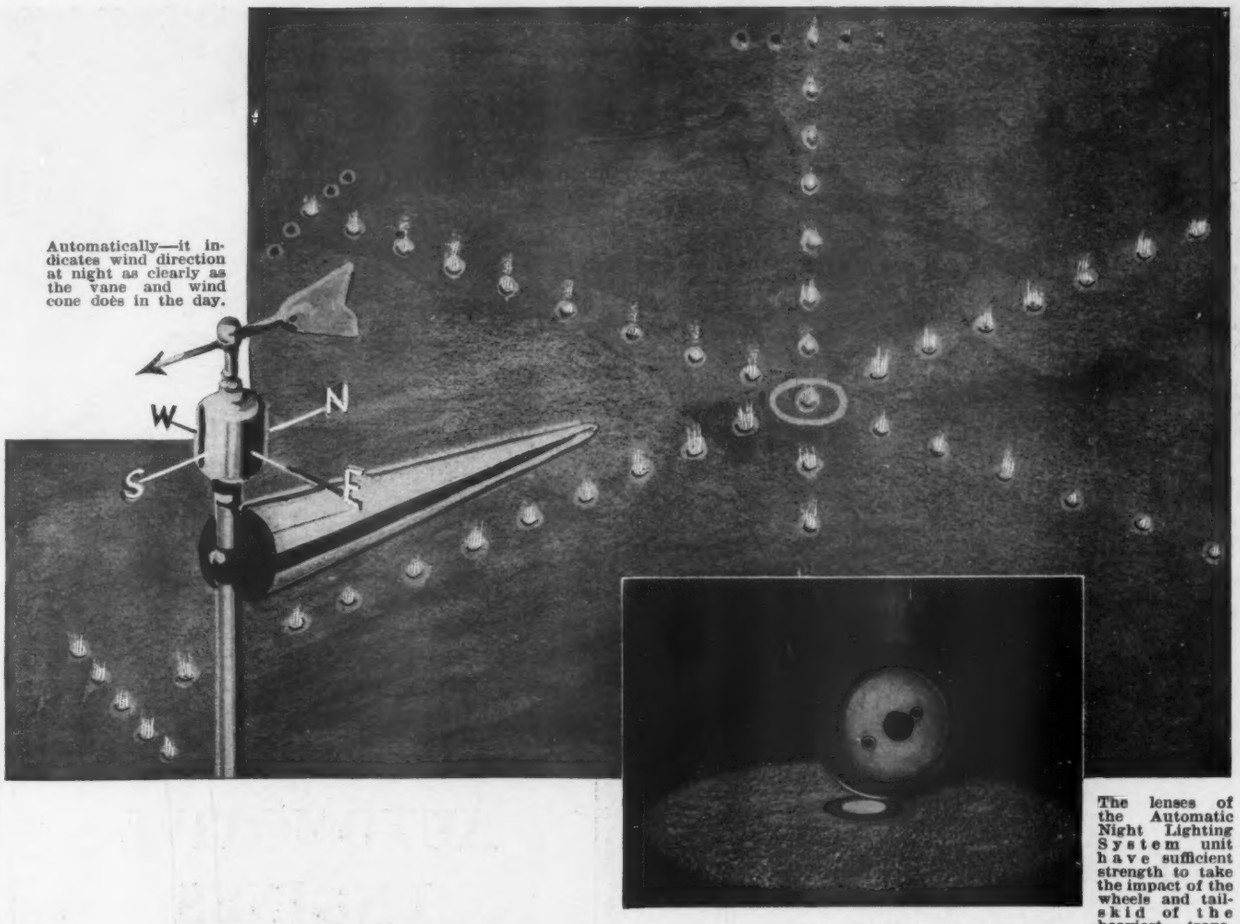
Further, Hamilton Standard propellers can be stored without deterioration. Wind tunnel tests have shown them to have decided advantages in performance over wood propellers of the same rating, and this definite superiority pays dividends in fuel economy.

Hamilton Standard propellers are available in a variety of stock sizes and types—and arrangements may be made for making up special designs. Correspondence is invited on propeller problems of any sort.

HAMILTON STANDARD PROPELLER CORPORATION

PITTSBURGH, PENNSYLVANIA

DIVISION OF UNITED AIRCRAFT AND TRANSPORT CORPORATION



Automatically—it indicates wind direction at night as clearly as the vane and wind cone does in the day.

The lenses of the Automatic Night Lighting System unit have sufficient strength to take the impact of the wheels and tail-skid of the heaviest transport ship.

The Automatic NIGHT LIGHTING SYSTEM says:

"Land into the wind *on the dotted line*...."

HAILED by outstanding figures in the aviation world—as the greatest contribution to the safety of night flying—no airport, contemplated or established, can be termed truly modern without the factors of safety this new, simple, and efficient lighting system offers!

It comprises a series of lights, mounted one hundred feet apart on the runways. At each end are mounted lights fifty feet apart at right angle to the runway. These lights are automatically illuminated by the action of the wind on the wind vane. As the wind changes the correct landing direction is automatically indicated.

This System was selected for the Grosse Ile Airport at Detroit, Michigan—a division of the Detroit Aircraft Corporation—one of the largest and most modern airports in the World—after a careful consideration of *all* available systems!

Learn more about it—write for particulars!

Advantages of the System Include:

- Indicates true ground level at all times.
- Automatic control.
- Indication of proper runway to land on.
- Indication of wind direction.
- Indication of runway length.
- Efficient under the most severe weather conditions.
- Shows drift of plane.
- Does not blind pilot—(diffused light)
- Low operating cost.

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DETROIT'S NEW CITY HANGAR BEING RUSHED TO COMPLETION

for the

ALL-AMERICAN AIRCRAFT SHOW

APRIL 5-13

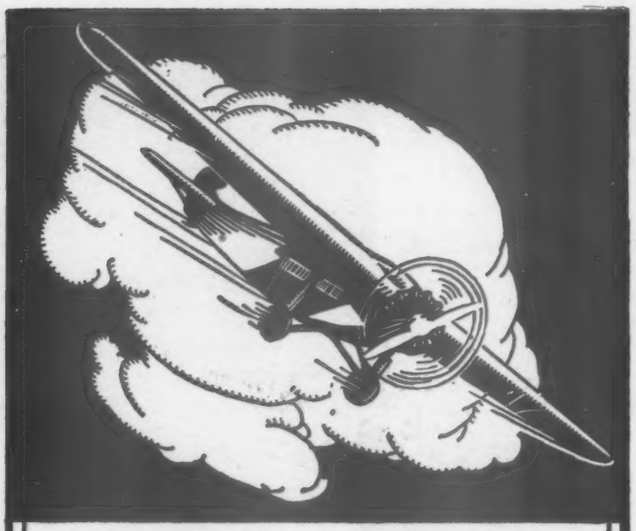
Detroit's new City Airport and million-dollar Hangar—scene of the Third Annual All-American Aircraft Show—is fast nearing completion. This modern aviation center will be ready in ample time for the grand opening of the Show on April 5.

The All-American Aircraft Show—the nation's outstanding aeronautical exhibition—offers unusual advantages. Demonstrations can be given from the flying field directly adjoining the exhibition building. Although the major portion of the new hangar's 200,000 square feet of floor area has already been reserved, space is still available for your exhibit if you make your reservation at once! Remember, the Detroit Show is the *selling* Show

OFFICIAL SANCTION

The All-American Aircraft Show is held annually under the auspices of the Detroit Board of Commerce Aircraft Bureau and is sanctioned by the Aeronautical Chamber of Commerce of America, Incorporated.

For full particulars apply to
RAY COOPER, Manager
Aircraft Bureau, Detroit Board of Commerce



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on a production or experimental basis

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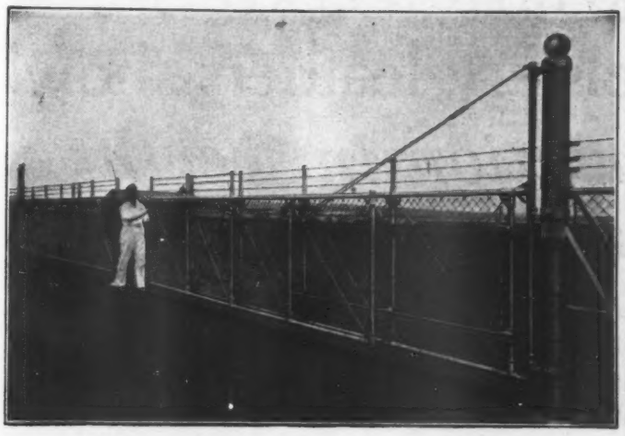

Opens Wide Enough for a Large Plane

A special feature of Cyclone Protection for Airports . . . .

This wide airplane gate is easy to operate. Roll it part way, then swing it. Like the rest of Cyclone Fence, this gate is constructed and erected to stand up under many years of hard usage.

Many leading airports install Cyclone Fence so that crowds can be easily handled. It protects both spectators and fliers. It induces air tours to come to your city. It also helps your airport become a terminal for air lines. Stimulates interest in aviation.

Cyclone Fence is strong and durable. Built so that top rail will not sag, nor posts lean, nor the fabric lose its rigid strength.

Practically every part of Cyclone Fence is made of copper-steel, heavily hot-dip galvanized. Fabric is covered with a smooth, dense coat of pure zinc. No chance for rust to start.

Erected on H-column posts — the strongest and most durable posts made. Cyclone Fence is erected by our own trained men. We take complete responsibility. Cyclone Fence Company is probably listed in your phone book. If not, write us.

All chain link fence is not Cyclone. This name plate identifies the genuine Cyclone Fence.

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Here is light weight for Aviation

Colonial Grain Aviation Leather is designed and manufactured for the aviation industry—not for automobiles, shoes, or furniture.

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Samples on application.

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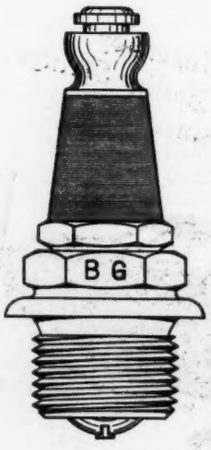
MICA AVIATION SPARK PLUGS



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WHEN valuable equipment is involved
WHEN priceless passenger cargoes are carried
WHEN safety, reliability and economy are important
WHEN there must be positive foreknowledge of performance

THEN

There is one logical choice for the spark plug equipment—B. G. plugs which have established their leading position by innumerable victories and records and by millions of miles of flight in military, commercial and sport service.

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THE B. G. CORPORATION

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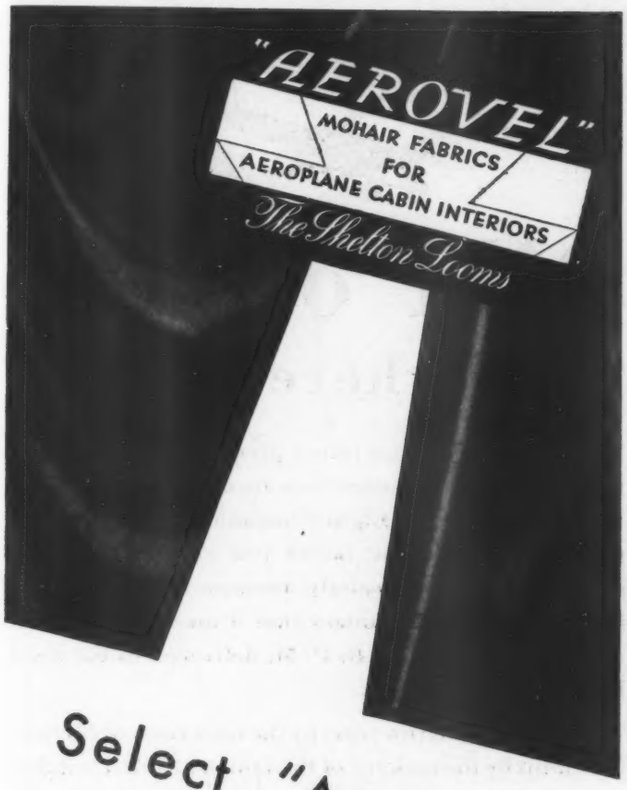

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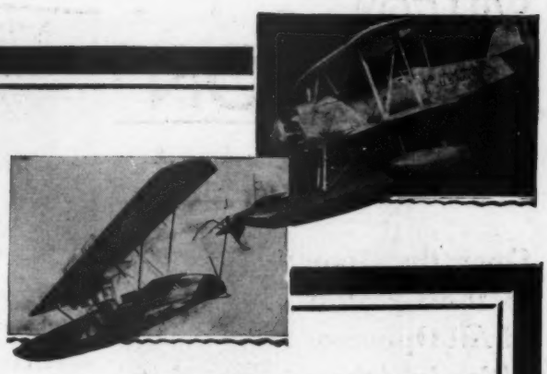

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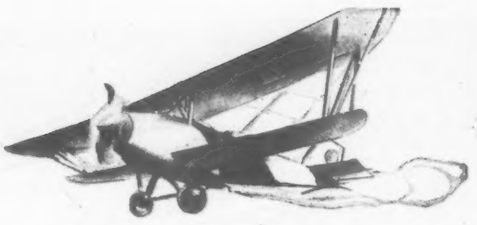

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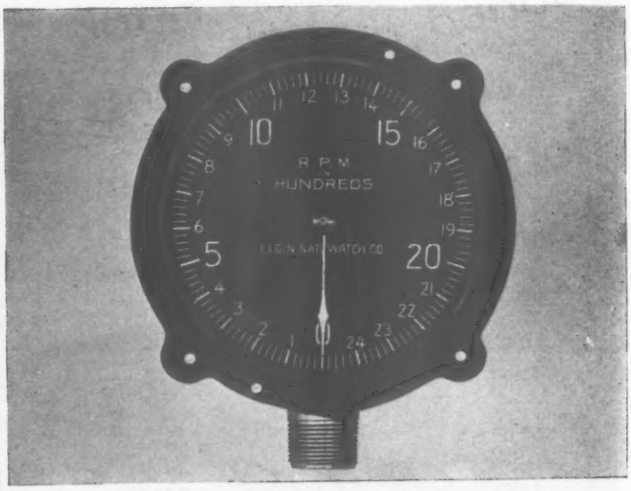
The easiest way to get into a predicament like that is to run your motor faster than its economical R. P. M. When you have an Elgin Chronometric Tachometer upon your instrument board you know your engine speed, accurately, precisely, because the principle of its construction guarantees that it must register with absolute accuracy the R. P. M. delivered to the head. It is inherently correct.

Thoroughly tested for years by the Government Air Services, built by the makers of the famous ELGIN watches, this splendid instrument may be installed separately or in combination with various assortments of instruments mounted in our handsome unit control board.



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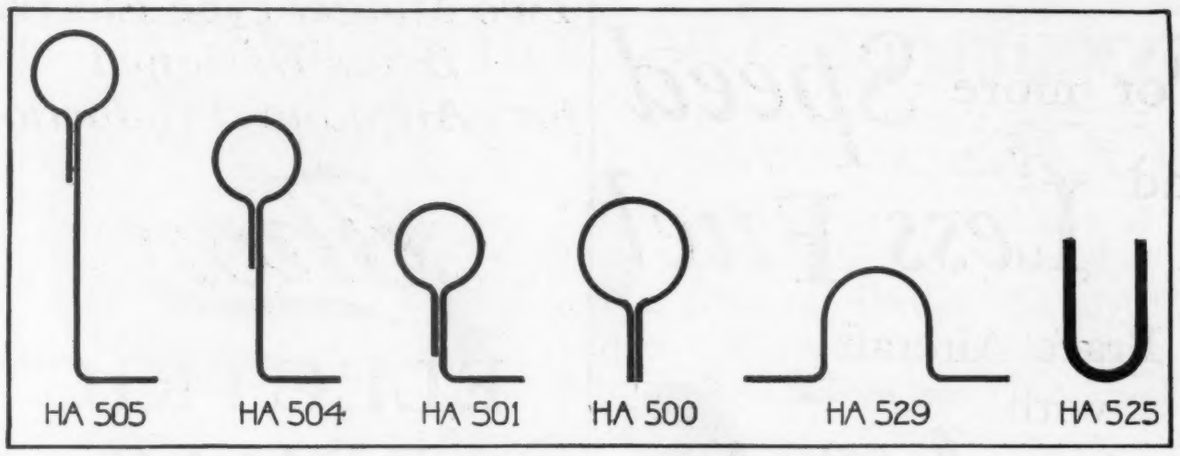

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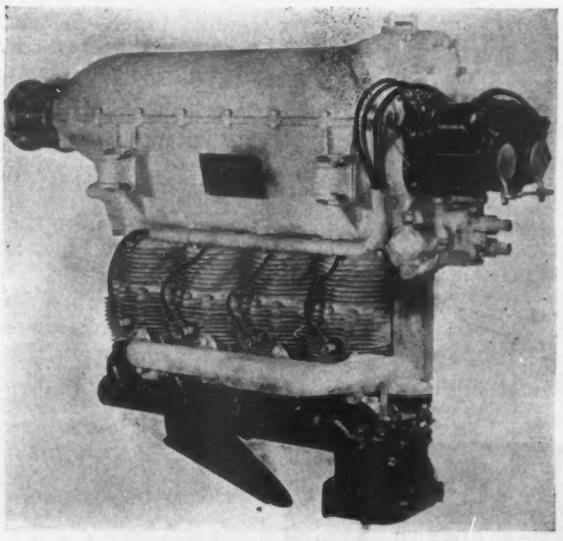

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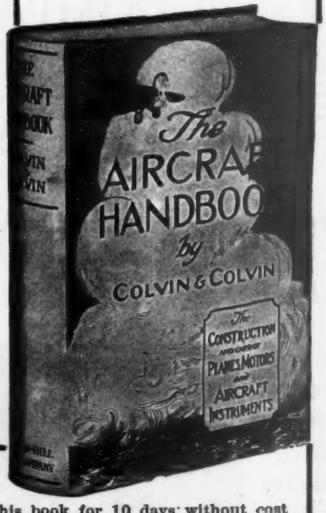

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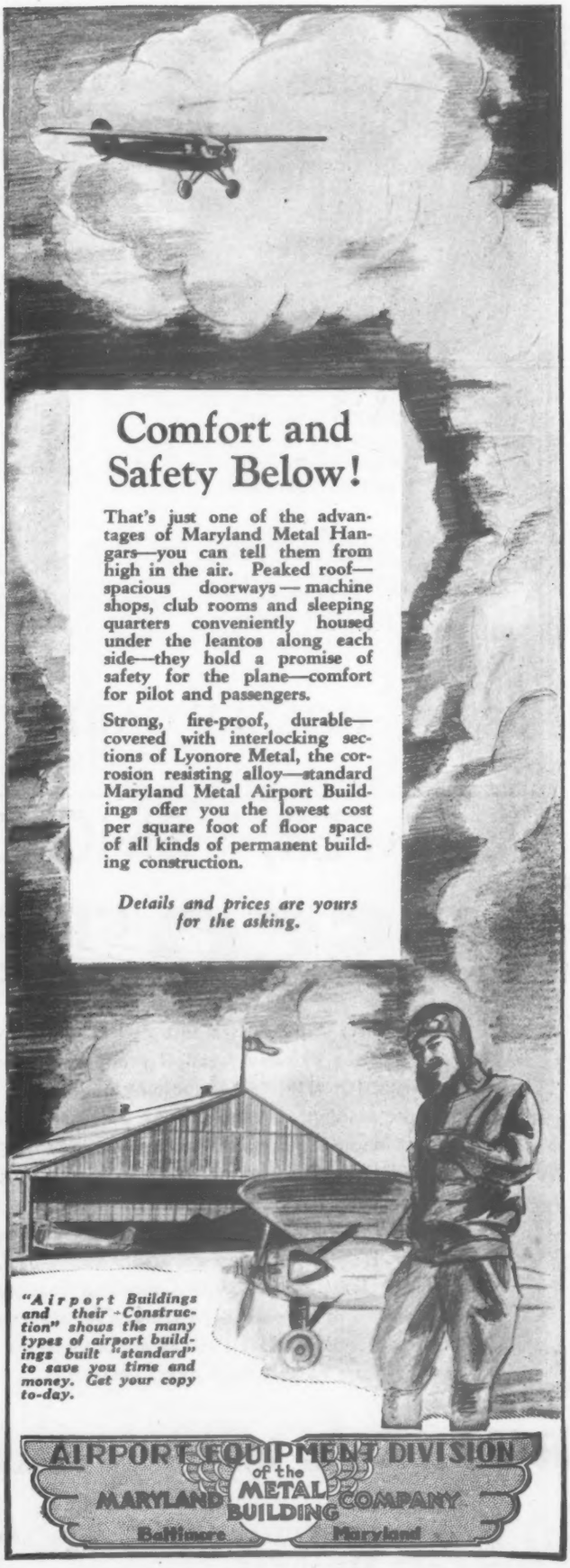

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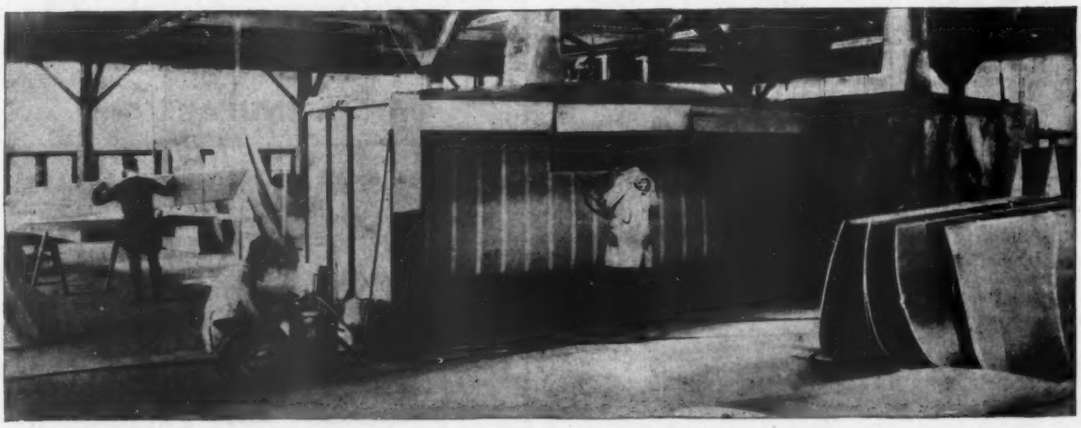

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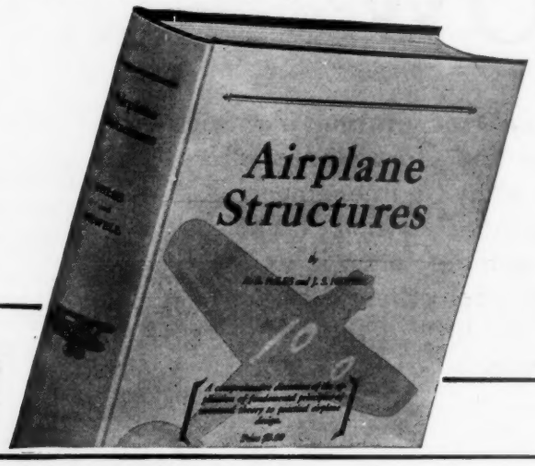

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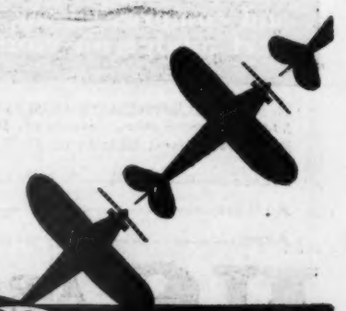

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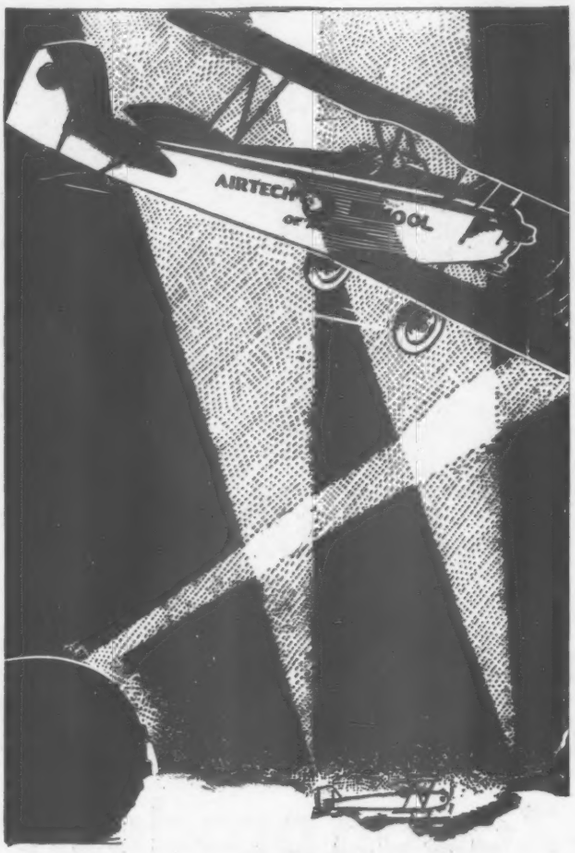

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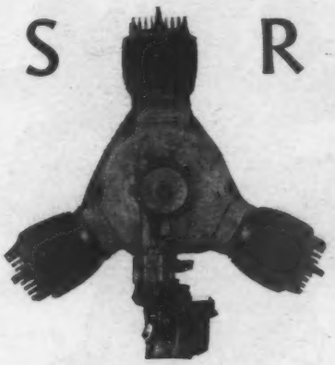

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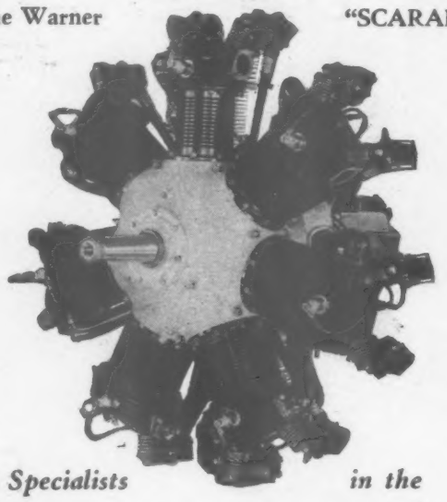

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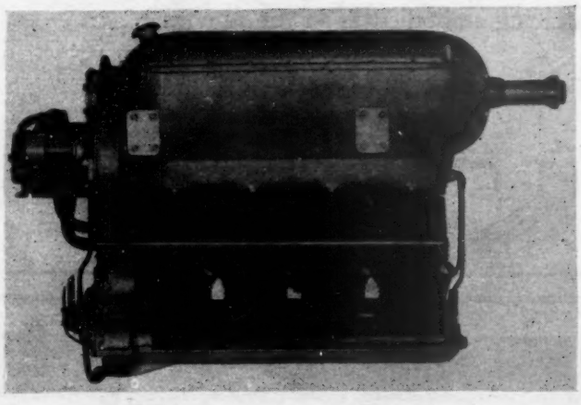

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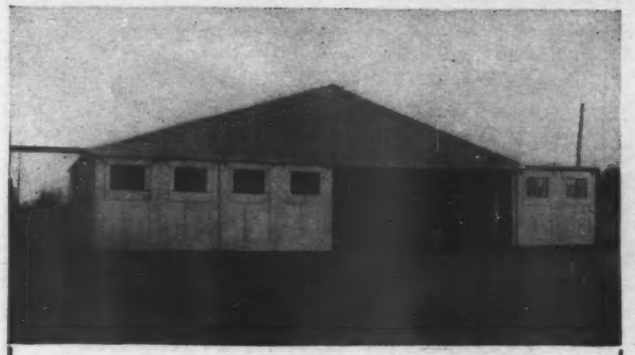

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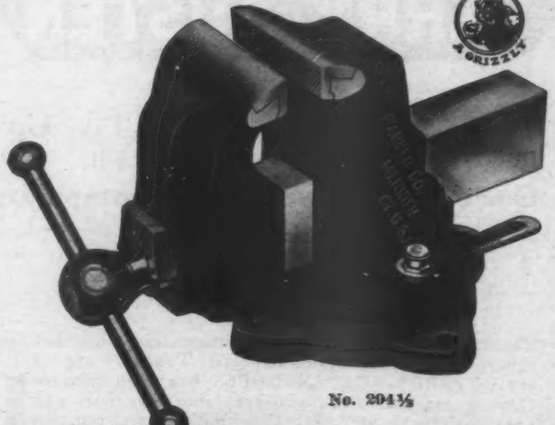

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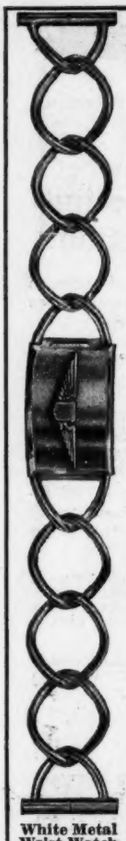

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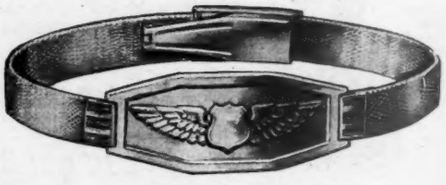

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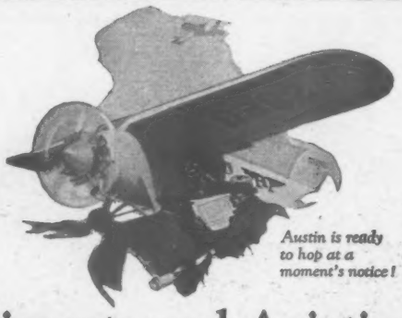

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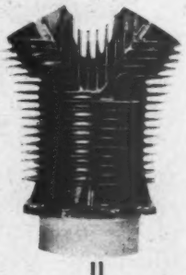

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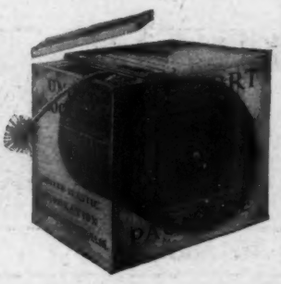

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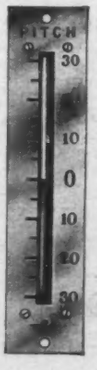

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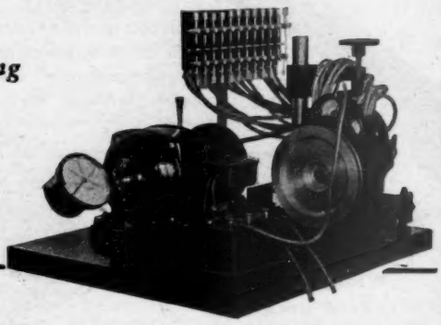

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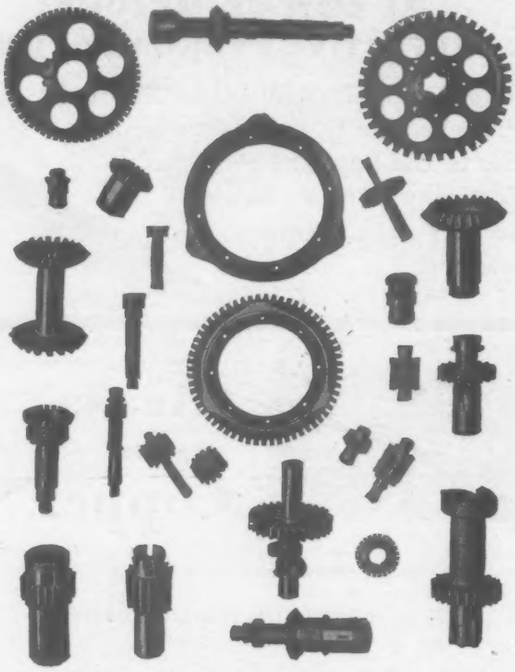

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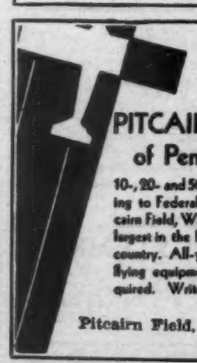

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1—Brand New Wright J6 300 Hp. 6-Passenger Cessna Monoplane.
These ships have less than 50 hrs. time. Are Brand New and in perfect condition.

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FOR SALE

Continued from preceding page

FOR SALE: One Hisso, A Swallow, new, never cracked up, many extras, sacrifice. One OX-5 Swallow training plane, excellent condition. One new Swallow TP with Kinner motor. These ships are in first-class condition and priced to sell. Wire or write Hoch Aviation Company, Butler, Pa.

FOR SALE—Two sets Edo pontoons, complete; suitable for planes below 200 horsepower; one set new, $700.00. Other slightly used, $600.00 f.o.b. San Diego. Wire, Earle Mitchell, Lindbergh Field, San Diego, Calif.

FOR SALE or trade, Hisso A motor complete for light car new Harding exhibition parachute $50. 8 Hisso tulip silichrome valves $70, cost $170. A. W. Baarley, Ellsworth, Wis.

FOR SALE—Wright Model E, 180 Hisso Motor. Salt cooled valves, 96 hours since complete overhaul. Complete with stacks and hub. Turns 1550 on ground. Price $400 crated. E. F. Dutro, Zanesville, Ohio.

FOR SALE or trade: Damaged Curtiss Challenger Engine, Velie M-5 less Magnetos, K-6 with Propeller etc., P.O. Box 1024, Tampa, Fla.

FOR SALE: Curtiss Robin with Millerized OX-5 Scintilla magneto. Motor has had 100 hours. Ship new. Located at St. Louis, Mo. Price $3,300. FS-361, Aviation, 520 No. Michigan Ave., Chicago, Ill.

CURTISS Robin for sale, with Millerized OX-5, motor has had 170 hours. Ship has had 160 hours. Both in excellent condition. Price $2,500. FS-362, Aviation, 520 No. Michigan Ave., Chicago, Ill.

FOR SALE or trade. Will trade new Nash Advance 6 Cabriolet or American Moth Plane on a three place new Production Plane. Ray Latimer, Ellwood City, Pa.

FOR SALE—One new OX-5. Price $350. One New Wright Hisso 150-H.P.A.—25 hours, price $425. Charles Descomb, 172 Grandview Terrace, Hartford, Connecticut.

FOR SALE: Hangar, Hisso motors, steel fuselage, used parts, as is. Filling station. Lunchroom furnished. Must sell at a sacrifice on account of illness of manager. Miami Aircraft Company, Miami, Oklahoma.

J-5, WHIRLWIND Waco for sale. New less than three months ago. Standard steel propeller, new trypod type undercarriage, nickel chromed struts, and exhaust stacks, Bendix heel brakes, and Haywood air starter. A real performing ship, and is priced to sell. E. A. Forner, Jackson, Mich.

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OXX-6 Curtiss motors guaranteed brand new. Also few government rebult OX-5 and OXX-5 motors. Prices reasonable. Motors shipped with privilege of inspection. Grand Marine Motor Co., 10439 Shoemaker Ave., Detroit, Mich.

PARACHUTES, new and used, rope ladders for stunt men, etc. Specify weight. Thompson Bros. Balloon and Parachute Co., Aurora, Illinois. Established 1903.

PITCAIRN with Curtis OXX-6 motor just overhauled. License NC-978. Price $1,500. Will be sold to best satisfactory bidder before March third. Miller Corp., New Brunswick Airport, New Brunswick, N. J. Tel. 4392.

RYAN Brougham in good condition, motor recently overhauled. Bargain price. Cleveland Pneumatic Tool Co., Cleveland, Ohio.

THREE-PLACE licensed plane, less OX motor; state condition, or will sell OXX-6 motor, one wing and tail surfaces for Swallow. Thomas A. England, 6715 N. 6th St., Philadelphia, Pa.

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WACO Taper wing fuselage in perfect condition. With or without J5 motor. Make offer. C. Dallas Inc., Buffalo, N. Y. Airport.

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ORNAMENTAL PROPELLERS approximately 20 in. long with large hub suitable for mounting clock, $4. Only limited quantity available.
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475 hours, 75 since motor overhaul, 180 gallon gas capacity and ten gallon oil tank. New tires and control cables. Ship just recently inspected and relicensed. Price $5,750.

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Findlay, Ohio

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WANTED: Several first-class aeronautical draftsmen. Experienced men only need apply. Pitcairn Aircraft, Inc., Pitcairn Field, Willow Grove, Pa.

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Am unable to finance alone, have an exceptional opportunity for gentleman or a group of men to finance the construction of an air-cooled Diesel engine, of nearly double the power as the present engines, less cost of production, economical in buy, remarkable simplicity, and more positive in operation hitherto unknown. Would require $10,000. Address Henry Pokorney, No. 105 Stanwix St., Rome, N. Y.

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New production pistons, pins and rings. Cylinders reground, pistons fitted, new valves, guides and seats installed. Work guaranteed and returned promptly. Write for particulars.

JOHN S. COX & SON, Terre Haute, Ind.

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1930

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ALPHABETICAL INDEX TO ADVERTISEMENTS

Name	Number
Ace Aircraft Co.	102
Aeronautical Corp. of America	32
Aircraft Products Corp. of America	12
Aircraft Steel Co., The	146
Airport Development & Construction Co.	96
Airport Lighting Inc.	131
Airtech School of Aviation	144
Albertson & Co. Inc.	58
Allen Elec. & Equip. Co.	152
Allison Engineering Company	63
Aluminum Co. of America	35 & 36
American Eagle Aircraft Corp.	76
American Hammered Piston Ring Co.	160
American La France & Foamite Corp.	59
American Propeller Co.	129
American Tar Products Co.	44
Anchor Post Fence Co.	108
Arrow Aircraft & Motor Corp.	141
Associated Airport Engineers	152
Austin Co., The	150
Axelson Aircraft Engine Co.	11
B. B. T. Corporation of America	79
B. G. Corporation, The	134
Badger Fire Extinguisher, The	73
Barnes, Gibson & Raymond Inc.	132
Baum, Seymour J. Inc.	135
Bellanca Aircraft Co.	84
Bendix Brake Co.	94 & 95
Bendix-Cowdrey Brake Tester, Inc.	95
Berry Brothers, Inc.	17 & 18
Bethlehem Steel Co.	28
Black & Decker Mfg. Co., The	68
Bohn Aluminum & Brass Corp.	Inside Front Cover
Brunner Mfg. Co.	77
Buhl Aircraft Co.	43
Cessna Aircraft Co.	147
Chambersburg Engineering Co.	104
Champion Machine & Forging Co., The	50
Chase Brass & Copper Co., Inc.	151
Cheney & Son, S.	40
Chevrolet Aircraft Corp.	148
Cleveland Pneumatic Tool Co.	126
Command-Aire Inc.	80
Comet Engine Corp.	107
Continental Aircraft Engine Co.	26
Cook Paint & Varnish Co.	66
Crouse-Hinds Co.	114 & 115
Cunningham-Hall Aircraft Corp.	152
Curtis Pneumatic Machinery Co.	69
Curtiss Aeroplane & Motor Co. Inc.	117
Curtiss Robertson Airplane Mfg. Co.	29
Curtiss-Wright Flying Service	20 & 21
Cyclone Fence Co.	133
Davis Aircraft Corp.	110
Delco Aviation Corp.	95
Detroit Aircraft Corp. (Parks Air College)	47
(Ryan Aircraft Corp.)	128
Detroit Board of Commerce	132
Duplate Corp., The	120
Eagle Ottawa Leather Co.	134
Eclipse Aviation Corp.	94
Edo Aircraft Corp.	27
Electric Storage Battery Co., The	81
Elgin National Watch Co.	136
Emsco Aircraft Corp.	19
Endicott Forging & Mfg. Co., Inc.	151
Ex-Cell-O Tool & Mfg. Co.	4
Fafnir Bearing Co.	111
Fairchild Aviation Corp. and Subsidiaries	53
Felters Company, The	48
Fleet Aircraft, Inc.	56
Flottorp Propeller Co.	146
Fokker Aircraft Corp. of America	45
Formica Insulation Co., The	92
Frisbie Aircraft Products	151
General Electric Co.	82 & 83
General Electric Co. (Aeronautical Equipment)	86
General Electric Co. (Merchandise Division)	67
General Electric Supply Corp.	30
Goodheart-Willcox Co., Inc.	136
Govro-Nelson Co.	146
Granville Bros. Aircraft Co.	116
Graybar Electric Co.	88 & 89
Great Lakes Aircraft Corp.	16
Gruss Air Spring Co.	5
Gulf Refining Co.	119
Hall Aluminum Aircraft Corp.	137
Hamilton Standard Propeller Corp.	130
Hamilton Watch Co.	72
Hartshorn Co., Stewart	138
Haskelite Mfg. Corp.	42
Holley Carburetor Company	139
Imperial Brass Mfg. Co., The	61
Independent Pneumatic Tool Co.	138
Indianapolis Tool & Mfg. Co.	152
Inland Aviation Company	34
International Derrick & Equipment Co.	100
Irving Air Chute Co.	46
Johns-Manville Corp.	123
Kari-Keen Aircraft, Inc. and Subsidiaries	75
Kelsey-Hayes Wheel Corp.	Inside Back Cover
Keystone Aircraft Co.	23
Kinner Airplane & Motor Co.	2 & 151
Light Manufacturing & Foundry Co.	71
Lobdell Emery Mfg. Co.	149
McGraw-Hill Book Co.	140
McGraw-Hill Publishing Company, Inc.	122
Martin Foundry, A. E.	150
Martin, Glenn L. Co., The	78
Maryland Metal Building Co. (Airport Equipment Division)	140
Meyrowitz, Inc., E. B.	57
Michigan Aero Engine Co.	137
Mono Aircraft, Inc.	64
Moth Aircraft Corp.	31
Moto Meter Co., The	93

Name	Number
New Standard Aircraft Corp.	125
Nicholas-Beazley Airplane Co., Inc.	146
Norma Hoffman Bearings Corp.	74
Oxweld Acetylene Corp.	24
Packard Electric Co.	143
Parker & Co.	150
Parker Co., The, Chas.	149
Parker Kalon Corp.	124
Parks Air College	47
Peck, Stow & Wilcox Co., The	151
Pennzoil Co.	9
Perry-Austen Mfg. Co.	150
Pioneer Instrument Co.	95 & Back Cover
Pitcairn Aircraft, Inc.	152
Porter-Cable Machine Co.	149
Port Orford Cedar Products Co.	13
Pratt & Whitney Aircraft Co.	109
Priggen Steel Bldg. Co.	149
Pyle National Co., The	99
Quincy Compressor Company	87
Raymond Mfg. Co.	133
Robertson Co., H. H.	70
Russell Mfg. Co.	139
Ryan Aircraft Corp.	128
S.K.F. Industries, Inc.	60
Scintilla Magneto Corp.	95 & 159
Searchlight	153-154-155-156-157
Shaw Co., B. Russell	148
Shelton Looms	135
Sikorsky Aviation Corp.	121
Skelly Oil Company	7
Sky Specialties	22
Standard Oil Co. of Indiana	106
Standard Oil Co. of N. Y.	98
Standard Pressed Steel Co.	142
Standard Steel & Bearings, Inc.	105
Star Compass Co.	148
Stearman Aircraft Co.	49
St. Louis Aircraft Corp.	6
Stromberg Motor Devices Co.	94 & 97
Stuart Aero Products, Inc.	112 & 113
Summerill Tubing Co.	33
Supreme Propeller Co.	151
Switlik Mfg. Co.	39
Szekely Aircraft & Engine Co.	145
Taylor Instrument Co.	147
Texas Company, The	55
Texas Pacific Coal & Oil Co.	54
Thomas & Armstrong	145
Thompson Products, Inc.	8
Titanine, Inc.	62
Travel Air Mfg. Co.	25
Truscon Steel Co.	85
Udylite Process Co.	103
Union Carbide & Carbon Corp.	38
Union Special Machine Co.	145
United Elastic Corp.	151
Uppercu-Burnelli Co.	127
U. S. Air Compressor Co.	144
U. S. Electric Tool Co.	52
Universal Aviation Corp. (Robertson Division)	118
Vacuum Oil Co.	3
Van Schaack Bros. Chemical Works, Inc.	141
Verville Aircraft Co.	41
Victor Mfg. & Gasket Co.	147
Viking Flying Boat Co., The	90 & 91
Waco Aircraft Co.	37
Warner Aircraft Corp.	14 & 15
Western Electric Co.	65
Whittelsey Mfg. Co.	51
Wiley & Son, John	142
Wilkening Mfg. Co.	10
Wright Aeronautical Corp.	101
Wyman-Gordon	158
Zapon Co., The	143

SEARCHLIGHT
Classified Advertising

AIRPORTS FOR RENT	157
BOOKS	157
BUSINESS OPPORTUNITIES	157
EMPLOYMENT SERVICE	157
EQUIPMENT WANTED	156
MISCELLANEOUS	157
POSITIONS VACANT	157
POSITIONS WANTED	157
REPRESENTATIVES AVAILABLE	157
SALESMEN AVAILABLE	157
SALESMEN WANTED	157
SCHOOLS, MISCELLANEOUS	157
SCHOOL PHOTOGRAPHY	157
USED AND SURPLUS EQUIPMENT	153
WANTED MISCELLANEOUS	157
WORK WANTED	157

AIRCRAFT SERVICE DIRECTORY

Advanced Aircraft Corp.	154
Air Associates, Inc.	154
Air Transport Equipment, Inc.	154
Allen & Drew, Inc.	154
Boston Auto Gage Co.	154
Burgess Norton Mfg. Co.	154
Cox & Son, John S.	154
Frisbie Aircraft Products Co.	154
Haskelite Mfg. Co.	154
Husband Aircraft Specialties	154
Ludington Phila. Flying School	154
New Hampshire Aviation & Marine Co.	154
Paragon Engineers, Inc.	154
Pioneer Instrument Co.	154
Phoenix Aircraft Products Co.	154
Posey & Co., J. V. G.	154
Rieker Instrument Co.	154
Visir Enterprises, Inc.	154
Weis, Inc., Geo. A.	154
Westchester Airport Corp.	154

PROFESSIONAL SERVICES

Aeronautical Research Laboratory	155
Offenstein, C. L.	155

WHERE TO FLY

Page	153

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In all outstanding flight achievements of 1929 SCINTILLA AIRCRAFT MAGNETOS continued to prove their stamina and never-failing qualities.

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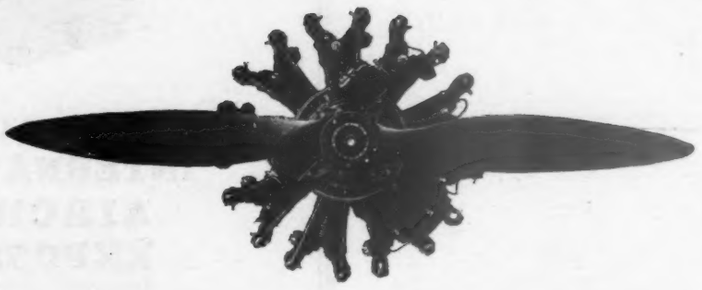

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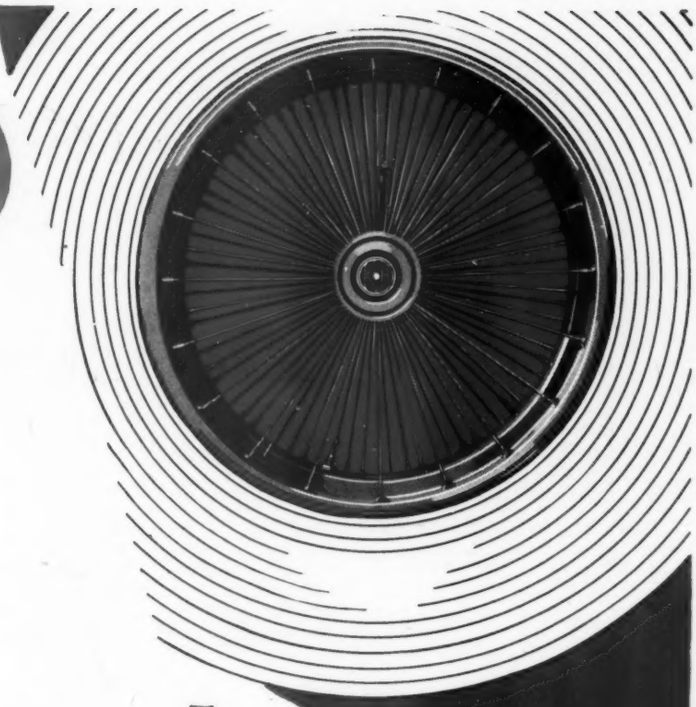

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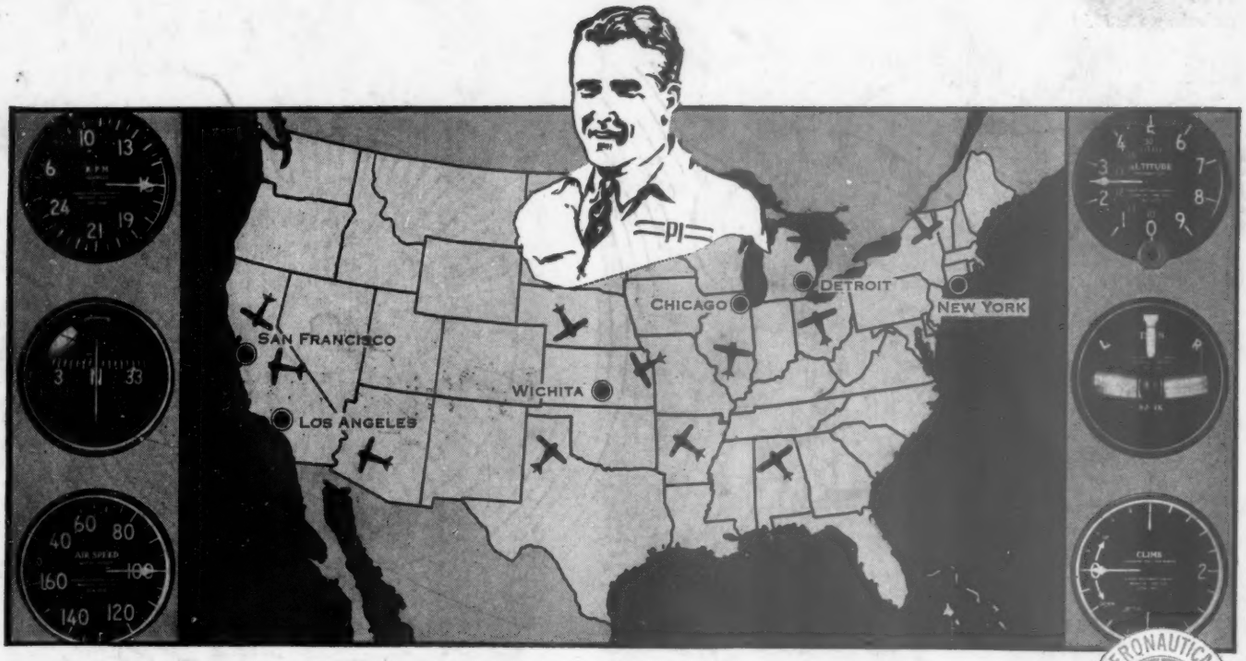

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Each of these is a complete organization made up of Pioneer trained engineers and service-men. They will check or repair your instruments, furnish new parts when necessary, counsel with you about proper instruments or design a new instrument board. Pioneer Engineering Service assures the same skill and painstaking care that you find in the design and manufacture of Pioneer Instruments.

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WICHITA, KANSAS: Pioneer Instrument Co., 420 West Douglas Street, Tel. Market 8175

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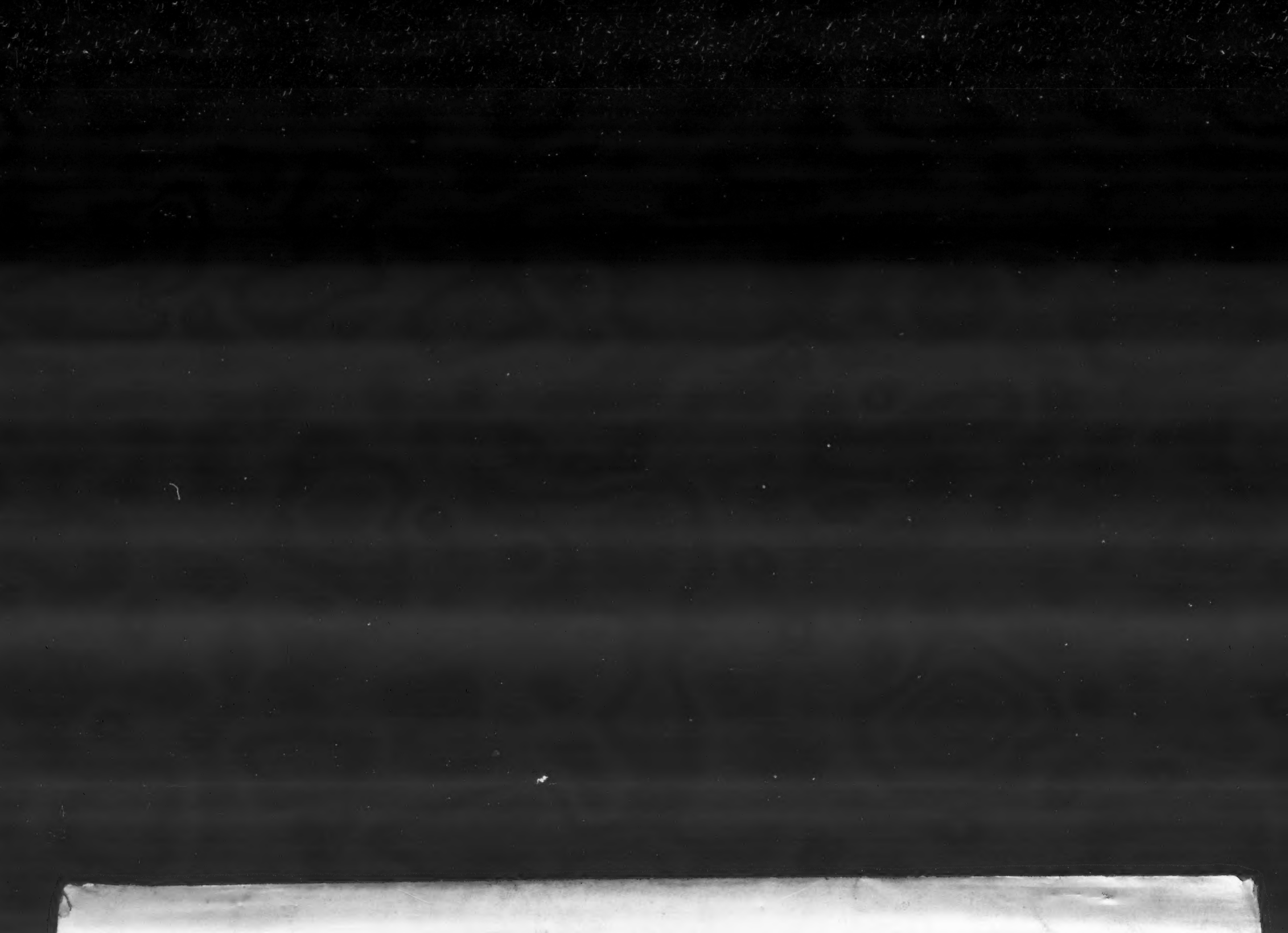
DIVISION OF BENDIX AVIATION CORPORATION

754 LEXINGTON AVENUE . BROOKLYN NEW YORK

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